



## **MITCHELL – The Standard**

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Operating Cameraman

On September 13, 1917, a camera maker named John Leonard walked through the doors of the Static Club (soon to become the ASC) in Hollywood, shook hands with President Charles Rosher, stepped in front of the membership, and demonstrated the prototype of the most famous camera in cinema history—the Leonard camera.

Never heard of it, you say? Maybe that's because its name changed. Within two years, Leonard sold his designs to Henry Boger and George A Mitchell, who used Leonard's work as the heart of their new machine —the Mitchell Standard.

Leonard's patented work defined the Mitchell's look and ensured the Mitchell's popularity. He filed for the first two patents in 1917: these covered the variable shutter, driven by planetary gears (US Patent No 1,297,703); and the distinctive rackover device (US Pat No 1,297,704), which, even in the patent drawings, set the Mitchell's appearance for the next half-century.

The Leonard film movement revealed his familiarity with Albert Howell's work; it used a flexible film guideway, pinned at the top, that alternately placed the film on either the pulldown claws or the fixed register pins. This is the same method Howell used in his first eight cameras, the wooden Bell & Howells.

In 1920, Leonard added the patent for this movement to the package (US Pat No 1,390,247). According to a Mitchell company history being prepared in 1954, the Leonard movement wasn't very satisfactory and a new design had to be substituted on short notice. The modified version added a third cam to improve the lateral stability, and it brought movable registration pins in from behind, rather than fixing them in front. This design worked much better; it became

known as the AA movement and it was the only drive available for the Mitchell until 1925. George Mitchell filed for a patent for this variation on May 12, 1920 and it was issued on January 10, 1922 (US Pat No 1,403,339).

Only nine years prior to the Mitchell's appearance, the Bell and Howell 2709 had spawned a revolution that doomed the beautiful wood-bodied Victorian cameras to obsolescence. The Leonard/Mitchell Standard wasn't a surprise on the same grand scale. It was a child of the 2709, a natural enrichment of the new themes: all-metal construction, single piece "mouse ear" magazines, built-in ground glass with an improved rackover, and so on. Leonard and Mitchell reflected on the 2709, saw its shortcomings, and found solutions that made life easier on the set.

Cameramen showed their gratitude by swamping the ***Mitchell Camera Company*** with orders, completely overwhelming the firm's limited production facilities. Between the time Floyd Jackman bought the first Mitchell camera in 1921 and the sale of a Standard to Fox Case Corp two days before Christmas in 1927, Mitchell sold 104 cameras (about one third the sales that the Bell & Howell 2709 achieved in its first seven years). As of June 29, 1923, Mitchell had delivered thirty-two of these cameras, and the company was operating 72 hours a week to catch up with their back orders, which at that point were running six months behind.

Production may have been slow at first, but the camera itself was fast. Efficiency is a recurring theme in the ads. "The Mitchell... lined up with exceptional quickness," Scott Sidney tells us.(1) "Owing to its wonderful equipment and mechanical arrangements, we are able to photograph at nearly twice the speed we formerly used," reports Victor Schertzinger at Fox, but he doesn't say what they shot with before.(2) Victor Seastrom at MGM went even further: "I have found through experience that during the course of a production, it will save in overhead cost an amount almost equal to the original cost of the camera."(3) Even better of course when the original cost was picked up by your cameraman.

Actually MGM had at least six Mitchells in their camera department, all bought new in 1922 and 1923; the studio was Mitchell's second best customer. First National did the best, picking up eleven in a two-year stretch—they had one out of every ten Mitchells in circulation and that's just counting the ones they bought new. Other studios also made multiple purchases: Christie took four, Fox put three on their lot and United Artists laid claim to a couple. Still, it was individual cameramen who bought most of the company's output in the 1920s.

Many of Hollywood's most sought-after shooters became the camera's first owners. In 1921 Gaetano 'Tony' Gaudio was near the head of the line to buy a Mitchell camera; he got #10. He'd been a cameraman since 1902, kept Carl Laemmle's IMP going photographically in the days of the Trust and went on to spend much of the 1920s behind his Mitchell as Norma Talmadge's cameraman.

The beginning of 1921 was exciting for Charles Van Enger: He bought the second Mitchell off the line to use on his pictures with Madame Nazimova. The spring of 1922 was even better: In March he was voted into the ASC and in April he left for Europe, first making a stop in Chicago to demonstrate his Mitchell to 30 cameramen in that town, practically in the Bell & Howell Company's parking lot. During the next two years he worked with Maurice Tourneur, King Vidor and Victor Seastrom. In 1924 he began a two-year stint as cameraman for Ernst Lubitsch, taking enough time off to shoot Lon Chaney's *"The Phantom of the Opera"* for Universal.

Charles Rosher, an enthusiastic and outspoken Mitchell fan, began shooting with Mary Pickford's Mitchell (#8) in the middle of 1922 and bought his own (#61) in 1925, but several sources say he was photographing Pickford films with Mitchells as early as her first feature, *"The Love Light"* in 1920, before Mitchells had serial numbers. Rosher was one of the best-known cinematographers in the silent era and not just because he was Mary Pickford's cameraman. He was one of the earliest lensmen at Nestor Films, the first permanent studio in Los Angeles. Always excited by innovations, he experimented with panchromatic filmstocks as early as 1919, long before they became practical. Among his numerous talents he was a master of split-screen work. During the 1920s Rosher spent a great deal of time in Europe and at least one trip abroad stimulated a European order for Mitchell cameras. Not long after his return from Germany in 1924, UFA Films ordered 2 Mitchell camera outfits with all built-in features, 10 magazines, 2 universal finders, 2 extension arms, 2 matte cutters, 2 sunshades, 6 tripods, heads and cases, a total sale of \$10,000. On New Year's Eve 1924 the Mitchell company sent them cameras #45 and #47.

Fellow ASC member James C. Van Trees was also an enthusiastic Mitchell owner; as an independent cameraman he'd use camera #4 throughout the 1920s at Lasky Studio, Metropolitan and the flashy and aggressive First National, working with the likes of William Desmond Taylor and Rudolph Valentino and lensing pictures like *"Flaming Youth."* After picking up his Mitchell on April 30, 1921, he kept a Pathe camera (#1110) around for a while, but finally put it up for sale in the fall of 1924.

George S. Barnes joined the growing family of Mitchell owners some time prior to May 1922. He carried it with him to the King Vidor Studios, to Metro, to Cosmopolitan and on to Samuel Goldwyn Productions, shooting a wide variety of films including *"Son of the Sheik"*, *"The Winning of Barbara Worth"* and *"Sadie Thompson"*.

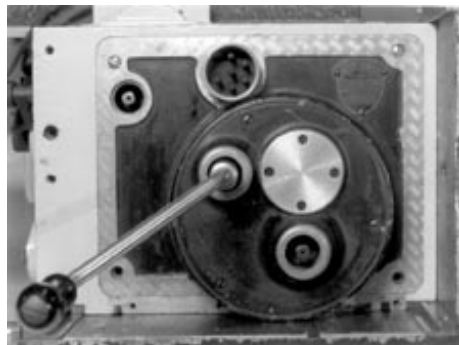
Norbert F. Brodine bought a Mitchell around June 1922, vowing to use nothing else from then on. His Mitchell captured a three-year series of Frank Lloyd pictures as well as *"The Sea Hawk"* and *"The Silent Watcher"* among his two-score silent features.

Sol Polito bought a Mitchell camera in June 1922, becoming the 7th ASC member to own the new machine. (The other six are named above.)

Attracted by the rackover feature, Arthur Miller joined the Mitchell club in 1923. His Standard replaced the Bell & Howell he got from Famous Players-Lasky, which in turn replaced the Pathe he'd bought as a newsreel cameraman. At least one other cinematographer, Charles Rosher, followed this pattern of ownership.(4)

Georges Benoit started cranking his new Mitchell (#32) in July 1923. Benoit epitomized the wide-roaming cameraman of the early days in film; he already had 16 years of experience in France, Africa, South America and on both coasts of the United States.

His physical dexterity and camera skills were honed to a fine edge; in one scene for *"The Rubaiyat of Omar Khayyam"* he made 49 overlapping exposures. Less than a year after buying his Mitchell he had one of the "scares of his life" when the wind knocked a reflector against his camera and it rolled 35 feet down a bluff. The camera was undamaged, a testament to its rugged construction.



As of November 1923 Alvin Wyckoff was reportedly a Mitchell owner but he didn't show up in the company's sales records till he bought #99 in October of 1927. The man who shot *"Joan the Woman"*, *"Male and Female"*, *"Blood and Sand"* and *"The Cheat"* would have no trouble making good use of a Mitchell during his ongoing relationship with Cecil B DeMille, a relationship that ended abruptly and permanently when Wyckoff helped establish the first union for cameramen, Local 659. (Editor's note: Now Local #600.) (5)

In 1925 JR Lockwood owned Mitchell camera #49, which he was offering for sale "new" in the *"American Cinematographer"*. He spent many years shooting comedies for Mack Sennett beginning in 1914 and ran an active camera rental business throughout the silent period and on into the coming of sound. By 1930 he had three Mitchell sound cameras available for rent and more than one Bell & Howell 2709 for sale, a clear reflection of the changing technology.

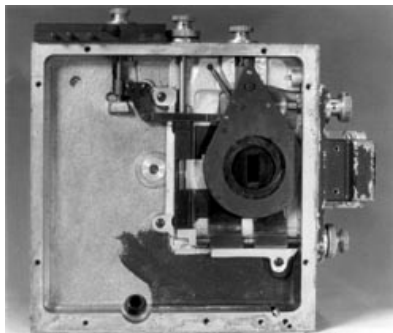
Later in 1925 J D "Dev" Jennings was shooting with Mitchell #25 at the Metropolitan Studios on a horse racing picture called *"The Million Dollar Handicap"*. On the same film he's also reported to have used John Boyle's invention that piggy-backed a 2709 and an Akeley on a single tripod (2709 on top). Within a year Jennings would be working with Buster Keaton on *"Battling"*

*Butler*". I'm not sure whether Mitchell #25 was his camera or the company's, but I'll wager he kept it close to him. Four years earlier at Christmas his own Bell & Howell (#474) had been stolen from the Robertson-Cole studios.

The "*Ben Hur*" chariot race was a great workout for cameras and cameramen, drawing in much of the cinematographic talent of Hollywood. There were six Mitchells among the battery of cameras, and the director of the race, Reeves Eason, was especially pleased with how quick the Mitchell was to operate. "Its saving in time alone proved of inestimable value."(6)

No camera has ever been so well equipped for special effects work; it was another reason for the Mitchell's immediate popularity. The lenses could be swung off-axis in the turret, giving the same effect as the rising front on a large format still camera: the equivalent of a 15° tilt without the converging verticals that you see when a negative is actually tipped back. Early Mitchell Standards could also be equipped with an extensive array of optional effects devices between the lens turret and the shutter. The first layer was an iris that could be adjusted to any part of the frame. Below that lay a set of four straight-edged mattes that could be adjusted independently into the picture area from top, bottom, left and right. Deeper yet was a wheel with nine pre-cut mattes (binoculars, keyholes and the like) that could be swung into place behind the lens and an equal number of blank matte holders for custom mattes; these proved suitable for gel filters in later years. In fact later Mitchells eliminated the pre-cut mattes on this wheel and provided blank holders in all the positions. Later still the matte wheel was eliminated completely along with the iris.

All these early Standards had the original AA drive which limited their frame rate to about 32 fps. It was Friend F. Baker who field tested the first high-speed Mitchell AB movement at the end of 1925. In a letter written May 24, 1927 he tells the Mitchell Co. that he's exposed over 150,000 feet with the movement at all speeds and making multiple exposures at as much as eight times normal speed. He used it to do the photographic trick work on eight films, including "The Better 'Ole", "The Winning of Barbara Worth" and "Old San Francisco". On the last-named film he tested two additional high speed movements on an earthquake shot and all three cameras worked fine.(7)



A few months later in 1927, perhaps influenced by Friend Baker's endorsement, Donald Keyes bought a super-speed Mitchell with a range of lenses from 35mm

to 12 inches. By now the serial numbers were up to 101 and the silent era was drawing swiftly to a close. Mitchell cameras on the other hand were just beginning a long and productive service life. I saw one on the street just the other day, shooting wild footage for a commercial.

Let's see this camera as it first appeared in 1921.

### **MITCHELL STANDARD CONSTRUCTION**

Painted or enameled metal. Available in smooth black or crackle black finish. Machined to the highest standards of precision. Mitchells were hand-built one by one. As a result, parts are not necessarily interchangeable between cameras, even of the same model. On used cameras, check the serial numbers carefully; most parts have them.



### **MAGAZINES**

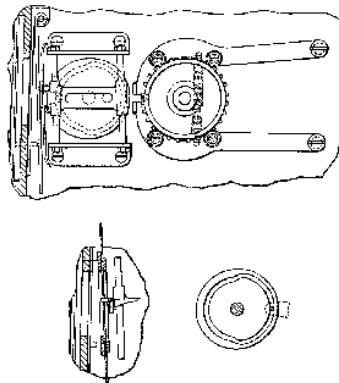
External, metal, double-compartment "mouse-ears" holding 400 feet of 35mm film. (1000 foot mags became necessary with the advent of talkies).

### **FOCUSING**

The camera box holding the gate, shutter and movement, and supporting the magazine, slides left and right on an "L"-shaped bed. At the front of the assembly is the upright of the "L," holding the four-lens turret as well as all lens-related effects devices. The under side of the bed attaches to the tripod. On the left side of the camera box, integral with the door, is a tube with a focusing eyepiece. A "T"-shaped handle on the rear edge of the bed controls the movement of the camera box across the bed. Turning the handle counterclockwise slides the camera box to the left side of the bed; in this position the film is behind the taking lens and the focusing tube is looking at a blank spot on the back of the upright. On turning the handle clockwise, the camera box shifts to the right, moving the gate away from the aperture and

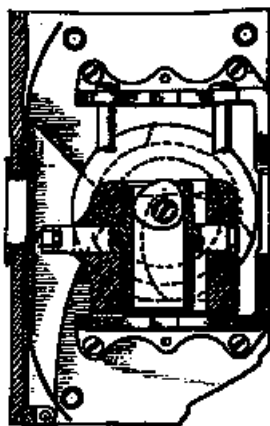
placing the focusing tube there instead. Focusing can then be done on a full aperture ground glass mounted at the front of the focusing tube. To turn the "T"-shaped handle, depress the button in the center of the spindle, as soon as the handle begins turning, *release the button*; the handle will then lock in the right place.

**WARNING:** If you don't release the button, you could be risking damage because some Standard cameras have no stop to prevent the camera box from sliding past the end of the track and detaching from the bed. If the handle does slip off the gears and you have to crank it back on, be sure that in its left and right locked positions the handle doesn't extend below the plane of the camera bottom; if it does, there's a risk that someone will rest the camera weight on the protruding handle and distort it.



The improvement that this rackover method offers over the similar method found on the Bell & Howell Studio camera may not be evident at first glance, but a few minutes of operation with both systems clearly reveals the advantages of the Mitchell technique. Both provide full-aperture viewing at the exact position the taking lens will occupy during the exposure, and in theory neither method requires the operator to disturb mattes and adjustments in front of the lens. But in practice it's usually necessary with the Bell & Howell to slide the matte box out on its rails in order to rotate the lens and shift the camera. With the Mitchell all the movement takes place behind the lens standard, and the lens with its preset effects remains truly undisturbed.

The cameraman is less reluctant about taking that last look at the scene to double-check just before shooting. This in itself is a major reason that the Mitchell so quickly became a popular competitor.



'AA' movement, from the patent

## Viewing

Viewing is possible on the ground glass when the camera is shifted to the focusing position, and this is the only absolutely reliable check for critical framing and effects; of course it's not possible during the actual taking of the scene. From the first the Mitchell Camera Co offered the conventional "spyglass" finders with individual objectives matched to the taking lenses. Beginning in the late Twenties the company also manufactured an excellent patented side finder that shows the scene upright and laterally correct on a large ground glass. Masks are inserted in this finder to indicate correct fields of view for the various lenses. The finder pivots to compensate for parallax. (Later finders have built-in matte ribbons to set the field of view.)

## Lenses

A wide range of lenses is available in Mitchell micrometer focusing mounts for installation on the four-lens turret. These mounts very closely resemble the focusing mounts for Bell & Howell lenses and it's *almost* possible to use Mitchell lenses and

Bell & Howell lenses interchangeably. However, certain modifications are necessary to install one camera's lenses on the other. The most critical difference lies in the distance from the turret face to the film plane—the "flange focal distance." In the Mitchell the depth behind the lens mount is 1.695". In the Bell & Howell this distance is 1.6875". The difference between the two is .0075", which is enough to affect the focusing scale of any lens switched from one camera to the other. In adapting a Mitchell lens mount to a Bell & Howell you can use shims to correct the disparity. The simplest way to correct the focus on a Bell & Howell lens, which will be too long on a Mitchell, is to scribe a new witness mark on the barrel, but this will place it in an awkward position for viewing.

Two other physical problems need to be addressed. The four machine screws that secure the lens in place are positioned differently on the Mitchell than they are on the Bell & Howell. To mount a Bell & Howell lens mount on a Mitchell turret face, it's necessary to recut the screw holes on the mount farther from the



center of the lens barrel, that is, to center the holes on the circumference of a larger circle. This alteration positions the holes right at the edge of the mounting flange. It follows then, in mounting Mitchell lenses on a Bell & Howell, the screw holes have to be re-tapped closer to the center of the mount. In this case to provide clearance for the screw heads, grooves must be routed in the edge of the protruding barrel of the mount. The final clearance that needs to be re-cut is on the inside edge of Mitchell mounting flanges. When mounting them on a Bell & Howell, in order to clear the wider shoulder in the center of the turret, a small arc has to be cut into the edge of the Mitchell mounting flange.

Any qualified machinist can make these changes and they don't jeopardize the integrity of the lens which will perform equally well on either body, but cameramen should be aware that a significant amount of machining is required to do the job right; there are dealers in used equipment who will assure you that "Oh yes; you can use these lenses on your camera, no problem," without telling you how much tinkering is involved.

## **Drive**

The earliest Mitchells had a "clapper" movement with many similarities to the original Bell & Howell drive. A pivoting carrier pinned at the top alternates the film between the fixed registration pins and the pulldown claws, which are driven by a drunken screw. Probably only a handful—if any—of these Leonard movements still exist.

The Type AA movement was initially installed in about 60 Mitchells. It uses three cams to control the pulldown, insert the register pins and apply lateral pressure to the film while at rest in the gate. Many of these movements were later pulled out and replaced with high speed movements, the type most commonly seen today.

Beginning in 1925 Mitchell was building cameras with the improved High Speed cam and gear movement and with the coming of sound they began offering it in two versions: Type AB (ball-bearings) and Type AC (sleeve bearings, much quieter). In spite of the "High-Speed" designation, only the AB movement can handle really high speeds (up to 140 frames per second but recommended to about 110); the AA and AC movements are rated to 32 fps. In all these movements, four claws engage the film, two on either side below the aperture. The movement can be cranked in either direction.

The shutter is a 170 degree disc with a planetary gear dissolving mechanism. The automatic dissolve on the Standard works at three speeds: 2, 4 and 8 feet. Manual shutter adjustments can be controlled with a lever at the rear of the camera which moves along a calibrated arc and can be locked at specific positions. The camera stops automatically at the end of the dissolve; a button unlocks the movement when you're ready to start up again. (Later models have no auto dissolve).



NOTE: In the Bell & Howell camera the shutter acts in front of the viewing system as well as the taking system; if you do a fade-out as the first half of a dissolve, when you go to do your setup for the incoming shot, you're unable to view and focus on the ground glass because the variable shutter is fully closed and can't be opened without risk of flashing the film. This isn't the case with the Mitchell because the shutter shifts away from the aperture to make room for the magnifying eyepiece--no matter how the shutter is set, it has no influence on parallax- free viewing between shots.

### **Effects**

A metal disc mounted just in front of the gate is cut with these masks: keyhole, round, small oval, large oval, binocular, horizontal split stage and vertical split stage. An index pin assures proper positioning. This is in addition to a standard mask slot which also accepts frames of film shot during previous sessions, for perfectly aligned match dissolves (another valuable Mitchell innovation).

A built-in iris can be positioned anywhere in the frame and closed to any size. From the rear of the camera the right hand knob on top controls the horizontal position of the iris in the frame and the left-top knob aligns the iris vertically. The iris itself is opened and closed with the large knob on the left side just above the finder.

Four individually controlled mattes are also built-in. Two concentric knobs on top center of the front standard control the upper and lower mattes. Two concentric knobs on the left side of the standard control the left and right side mattes. Nor is that all: using a knob next to the turret, the lenses can be rotated slightly to give the effect of a rising and falling front standard, which allows the field of view to be raised or lowered an equivalent of 15 degrees without tilting the camera and altering perspective.

The versatility of these arrangements can be matched on other cameras with a number of accessories, but nowhere is so much control over the frame available within the body of the camera itself.

NOTE: Though each of these devices is precision machined and positively controlled, operators should be cautioned that they can be moved into the frame inadvertently during the course of a day's shooting, and it's prudent to be aware of their settings.

### **Other Features**

A tachometer is available to indicate cranking speed. One accessory item available for hand-crankers was a special door with an additional shaft yielding 64 frames per turn; two turns per second on this shaft drives the camera at 128 frames per second.

### **References**

1. Scott Sidney's letter in a Mitchell ad, back cover of the American Cinematographer, February 1927
2. Letter in a Mitchell ad, back cover, American Cinematographer, March 1927
3. Letter in a Mitchell ad, back cover, American Cinematographer, February 1926
4. In many photos from the silent period, you'll see a Bell & Howell working as first camera and a wooden Pathe or Eclair as second camera, making the European negative. After 1921 you'd increasingly see the Bell & Howell as the second camera and the Mitchell as number one.
5. Brownlow: The Parade's Gone By.... Alfred A. Knopf, New York, 1968, p.227
6. The Mitchell Company used his letter as an ad on the back page of the American Cinematographer, October 1926
7. Mitchell ad in American Cinematographer, July 1927, back cover

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