

The 35-mm Motion Picture Camera from the Beginnings to the 1920s

By KARL MALKAMES

William Dickson, Edison's co-worker, and the Lumière brothers in France laid the groundwork for what became today's worldwide motion picture industry. Some of the most notable cameras from their time up to the 1920s are documented.

The 35-mm film width and the number and placement of perforations (Fig. 1) were first established through experiments by William Dickson, carried out for Thomas A. Edison in 1888. When the first delivery of motion picture film on record was made — in September of the following year — by George Eastman to Thomas Edison, the die was cast for what has become the standard gauge. The engineering genius of Dickson established the physical film proportions that have been found so ideal as to remain to this very day.

In attempting a review of contemporary camera design one should include perforators, printers, and projection equipment for a complete description of the chain of instruments from exposure of the film to its exhibition. However, here we shall only deal with the very beginnings when almost every moving picture machine served successively as a camera, then printer, and finally, with the addition of a lamphouse, as a projector.

Lumière

The Lumière brothers' *Cinematograph* (Fig. 2) was patented in Feb-

AUTHOR: Curator of Malkames Historical Cinemachinery Collection; Archival Film Reproduction Specialist, Scarsdale, N.Y.

ruary of 1895. In the following month it claimed the earliest date for a demonstration of projected moving pictures. This combination of camera, printer, and projector, the brainchild of Louis Lumière of Paris, was designed to accommodate the Lumière 35-mm film stock (Fig. 3) having one pair of round perforations per frame. Its reciprocal claw movement, actuated by a harmonic cam, was copied with variations for years to come by many designers of cine cameras and projectors.

Biograph

The 35-mm *Mutograph* camera (Figs. 4 and 5) was completed in 1899 by Herman Casler and William Dickson, then with the American Mutoscope and Biograph Company. Some of the very first films of such stars as Mary Pickford were photographed with this camera. It used the same design principles as its 68-mm parent. In an effort to avoid infringement of Edison patents, it perforated the blank film during exposure, and each frame was brought into place at a slightly different vertical height (Fig. 6) by means of a beater movement. A closer look at the *Mutograph* camera reveals an astounding number of innovations. Aside from the self-perforating fea-

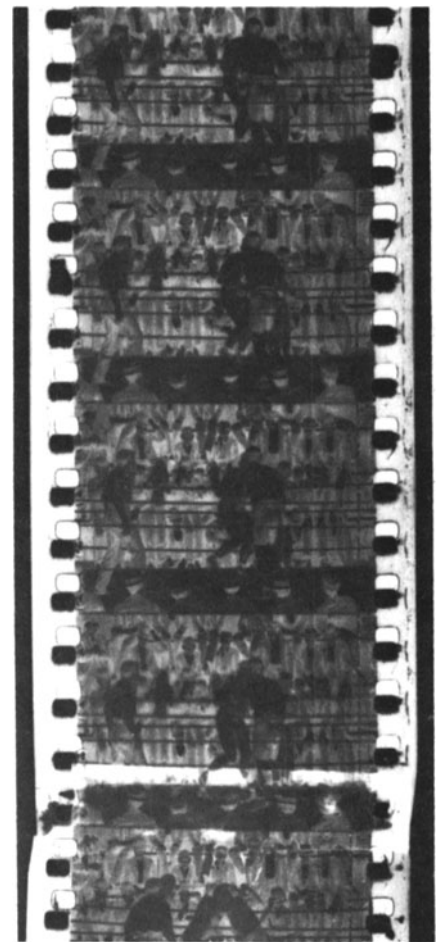


Figure 1. Edison's film dimensions and perforations of 1889. Enlarged paper print from a positive film clip. Note that negative and positive perforations are not aligned.

ture, we find a sophisticated vacuum system intended to hold the film flat at the aperture during each exposure; a variable shutter; a single-frame crank provision for time-lapse photography; and the eight frames-per-turn cranking that became the universal transport gearing standard. All this before the turn of the century!

No steadier picture than the one made with this camera could be found until 1912 when Bell & Howell introduced precision registration. This was due, of course, to the integrity of the camera-punched perforations. An equally ingenious *Biograph* printer sought out the random-spaced



Figure 2. Lumière's *Cinématographe* of 1895.

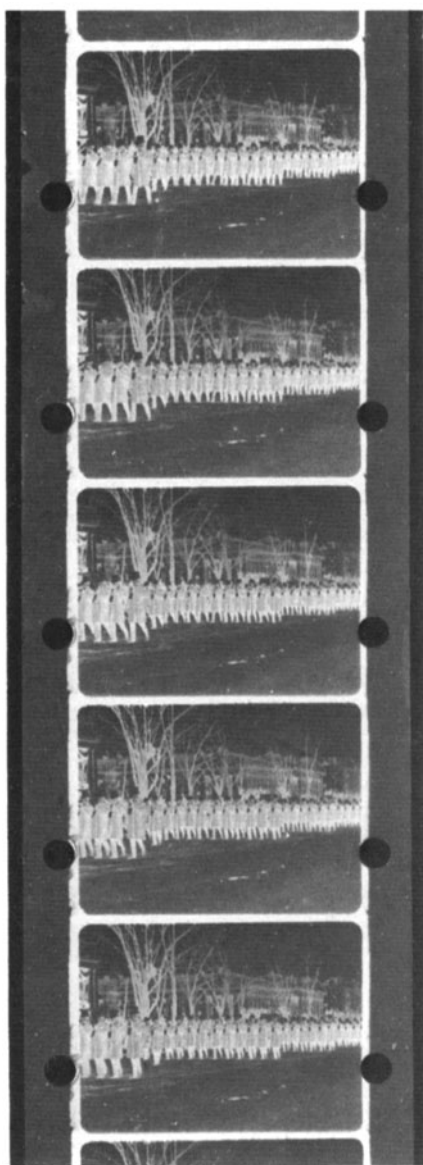


Figure 3. Lumière's film with round perforations. It could be used only with the *Cinématographe*. Enlarged paper print from a positive film clip.



Figure 4. Casler and Dickson's *Muto-graph* of 1899.

perforations. Spring-loaded pilot pins were used to join the negative with standard printing stock.

Other Early Camera Designs

The years that followed the creation of the remarkable machines of

Lumière and Dickson saw much frantic experimentation and innovation. Great monetary rewards were promised by the magic moving picture shows. They hastened the search for talent to design and build the required apparatus. The variety of mechanical principles employed in early

camera design reflects the ingenuity of their designers. Most 35-mm cameras in use up to 1912 incorporated sprockets and movements that accommodated a variety of perforation shapes. There was no dependable cutting and perforating standard for the available film stocks manufactured here and abroad. Perforations were, in most cases, custom punched for a particular camera system.

In America, historic images were recovered for posterity by Charles Urban's *Bioscope*, the *Schustek*, and the *Universal*. *Demeny*, *Eclair*, and *Gaumont* cameras were busy in France, and from Germany came the *Ernemann*, *Schimpf*, *Ertel*, and *Mess-ter* cameras. Notable among the many British cameras built during this period were the *Prestwich*, *Darling*, *Wrench*, *Moy*, *Williamson*, *Vinten*, *Newman* and *Sinclair* models.

Pathé

The most popular camera worldwide was, until after the first World War, the *Pathé* studio camera (Fig.

7) that Billy Bitzer used to photograph "The Birth of a Nation." The *Pathé* film transport movement resembled closely that of the Lumière *Cinematograph*. There was a good reason for it, because when the Lumière brothers decided to suspend the manufacture of their cameras after a catastrophic fire, they permitted Charles Pathé to use their designs.

Bell & Howell

Preceded by a wooden-cased model, the famous *Bell & Howell* studio camera (Fig. 8) made its debut in 1912. Very quickly it became the standard of the industry. The distinctively shaped aluminum body and magazine was the most outstanding camera profile seen wherever professional motion pictures were being photographed. The fixed pins of the unit "I" shuttle provided perfect registration with a full fit on the Bell & Howell perforation. At last, precision camera registration and a truly standard film perforation made possible all the superb process shots that the

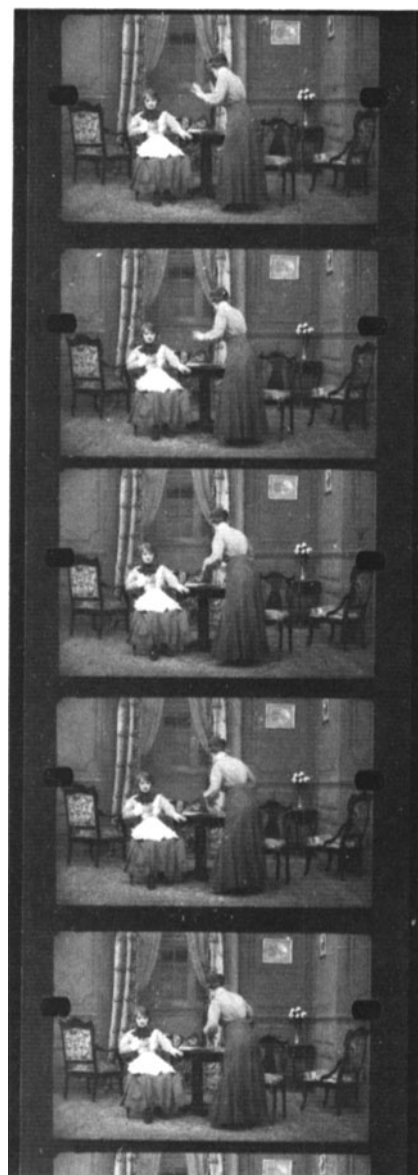


Figure 6. In-camera-perforated *Mutograph* film. Note random spacing of perforations and variable widths of frame lines. Enlarged paper print from a negative film clip.

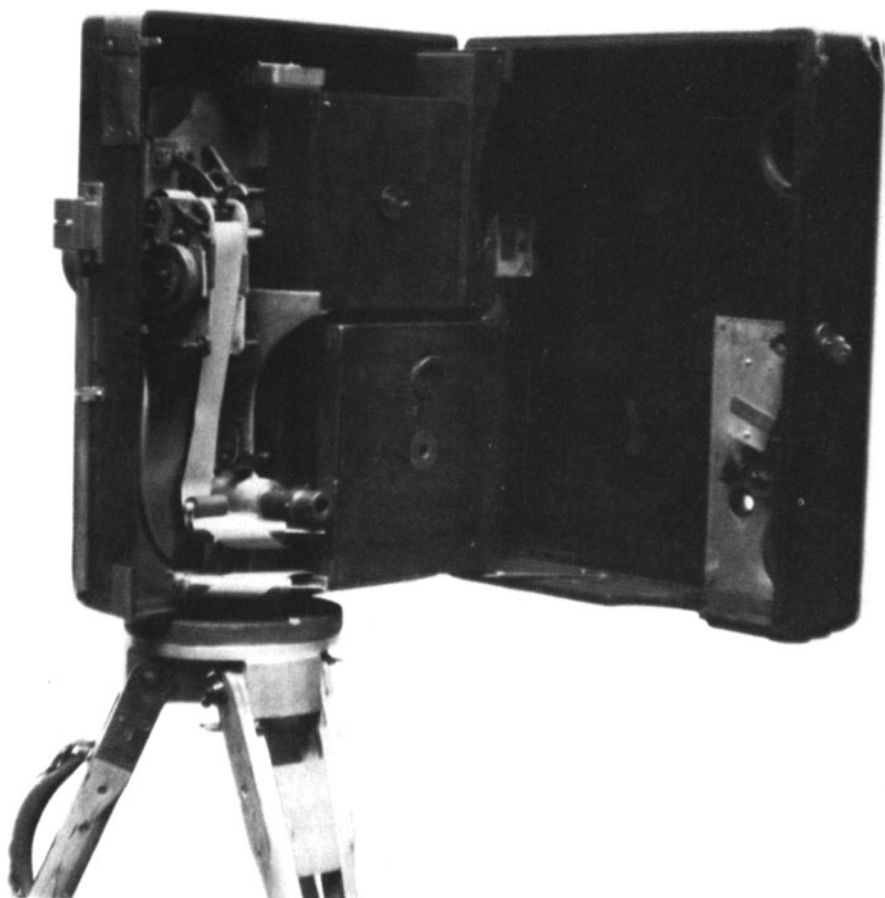


Figure 5. Inside view of the *Mutograph*.

camera artists were ready to create. In 1921 Bell & Howell added the high-speed check-pawl ratchet shuttle and the *Cinemotor*. The same company gave us the famous little 35-mm *Eyemo* in 1926, fashioned after the 16-mm *Filmo* of 1924.

Akeley

Perhaps the most singular and unusual instrument of all was the *Akeley* camera (Fig. 9). To satisfy his need for a camera to record wildlife on his frequent African expeditions, Carl Ethan Akeley found it necessary to design his own equipment before

the first World War. The result was a lightweight aluminum camera. It was complemented by the first quick-set, ball-leveling tripod with gyro-controlled pan and tilt head. A cylindrical focal plane shutter with a 230° open sector revolved around the entire camera mechanism inside the periphery of the outer casing. Close-coupled pairs of finder and objective lenses were quickly interchangeable and provided a practical long focal length capability. Extreme tilting angles complemented by an adjustable viewing tube, quick-change displace-

ment type magazines with internal feed sprocket, and a generally rugged construction made the old "Pancake-Akeley," as it came to be known, a favorite with generations of newsreel cameramen. An amazingly competent rod-and-crank movement with a single pin proved rock steady, performing equally well forward, reverse, or at high speed.

Debrie

No name was more prominent or respected in the field of cine-machinery than that of André Debrie. The

very first wooden-cased *Parvo* camera (Fig. 10) he built in 1908 had an optical channel that allowed viewing an erect image through the back of the film itself during exposure, as the prevailing stock was then sufficiently translucent. This then, was an initial experience akin to, but not the same as, reflex reviewing as we enjoy it today in almost every camera. Debrie's compact and efficient design with coaxial magazines gained immediate popularity and was destined to be copied by many companies such as *Askania* and *Ernemann*.

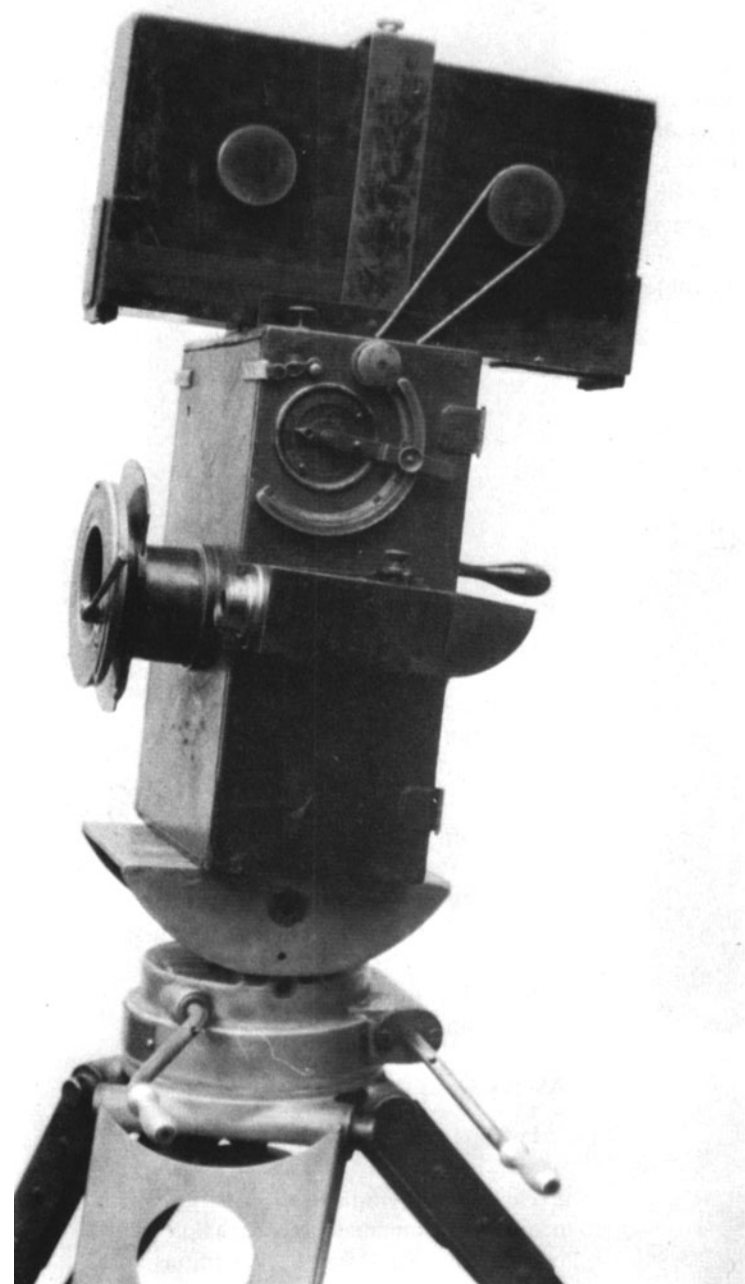


Figure 7. Pathé studio camera of 1900.

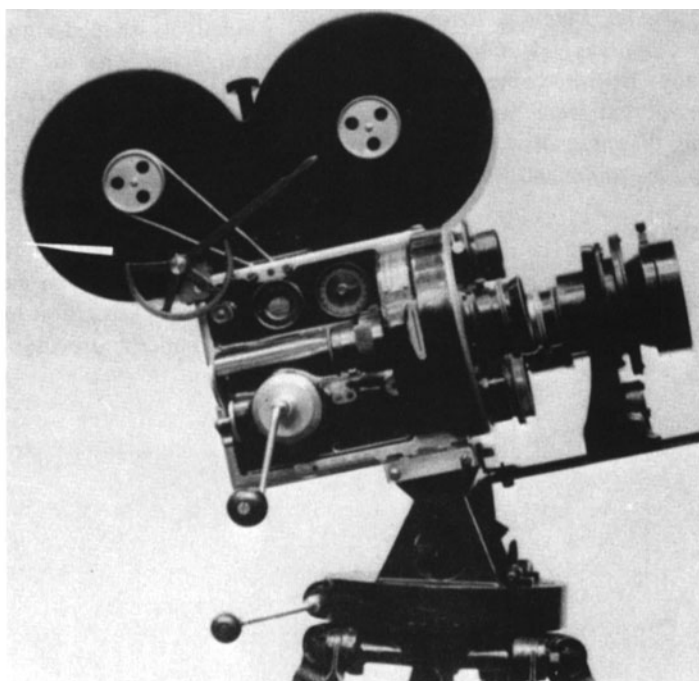


Figure 8. Bell & Howell studio camera of 1912.

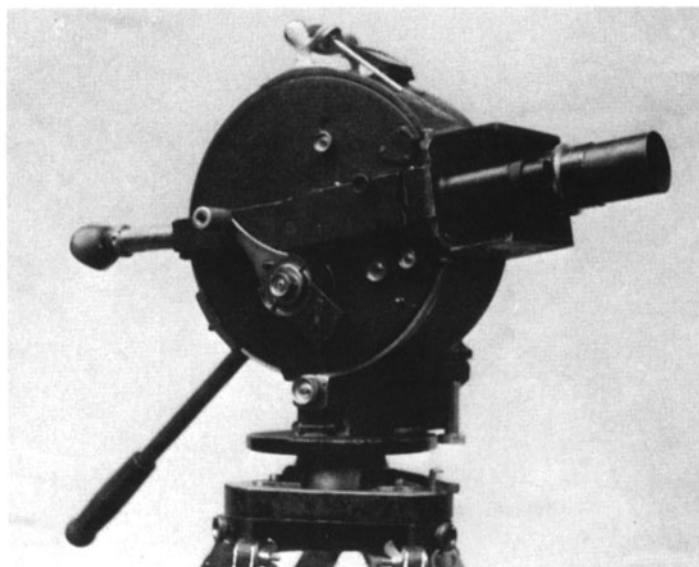


Figure 9. Akeley camera of 1915.

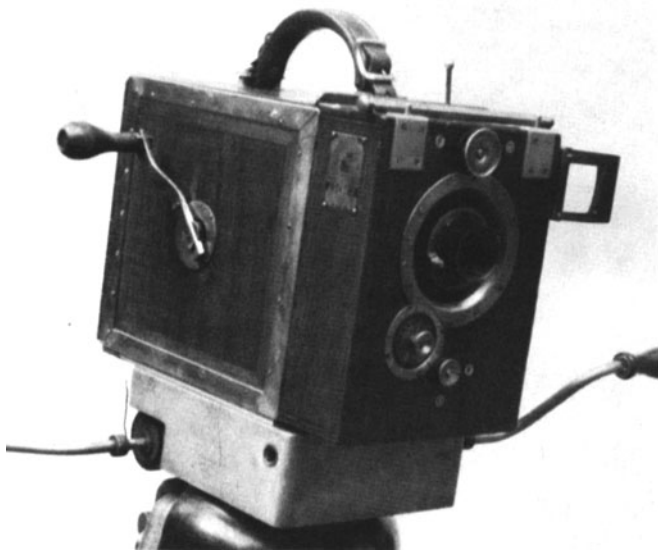


Figure 10. Debie's first wooden-cased *Parvo* camera of 1908.

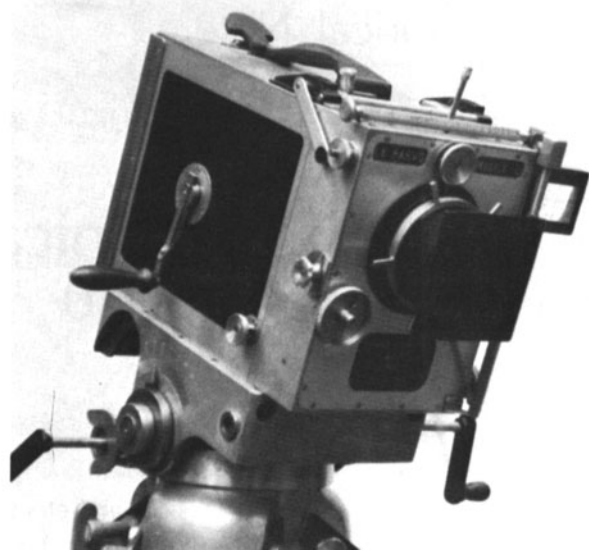


Figure 11. Debie's Model "L" *Parvo* camera, 1921, with automatic fade mechanism and ground-glass focusing.

In the early 1920s, Debie's model "L" *Parvo* (Fig. 11) was introduced as the most advanced of his compact 400-ft (120-m) line. For many years of the silent era it ranked as one of the world's top studio production cameras. The sophistication and superb craftsmanship of the "L" matches that of the finest photographic instruments ever constructed. One of its two registration pins was full-fit vertically and the other full-fit horizontally, ensuring precision and image steadiness on a par with the Bell & Howell design. From the very first wooden-bodied *Parvo* of 1908 through to the sound-proof *Super Parvo* in 1933 that rivalled the Mitchell BNC on most European sound stages, Debie quality was second to none.

Mitchell

In March of 1919 the first patents were granted on a camera destined to replace the *Bell & Howell* camera as the standard camera of the motion picture world. It was known first as the *Leonard* camera, after the man who worked with George Mitchell to develop the prototype. Its first movement resembled closely the *Bell & Howell* shuttle with fixed pins. Only a few of these three-cam shuttles were made however, and most standard and high-speed *Mitchell* cameras built thereafter were equipped with

the well known two-cam movement. Charles Rosher introduced the first *Mitchell* camera (Fig. 12) to a feature stage in 1920, with Mary Pickford in "The Love Light." Today, a final tribute to Mitchell may be seen in the *Panavision* movement which originated in the NC and BNC *Mitchell* models.

Final Remarks

Contributions of many other camera designers rightfully deserve equal recognition to round out this story.

However, this brief chronology has room for only some of the most prominent 35-mm cameras that were operated by cameramen from the very beginning of the silent era up to the advent of sound. The photographic quality of motion pictures produced over all these many years is due in no small measure to the efforts and talents of the designers who engineered the cameras. The latest *Arriflex* and *Panavision* equipment is but a contribution of this legacy of excellence passed on by their forebears.

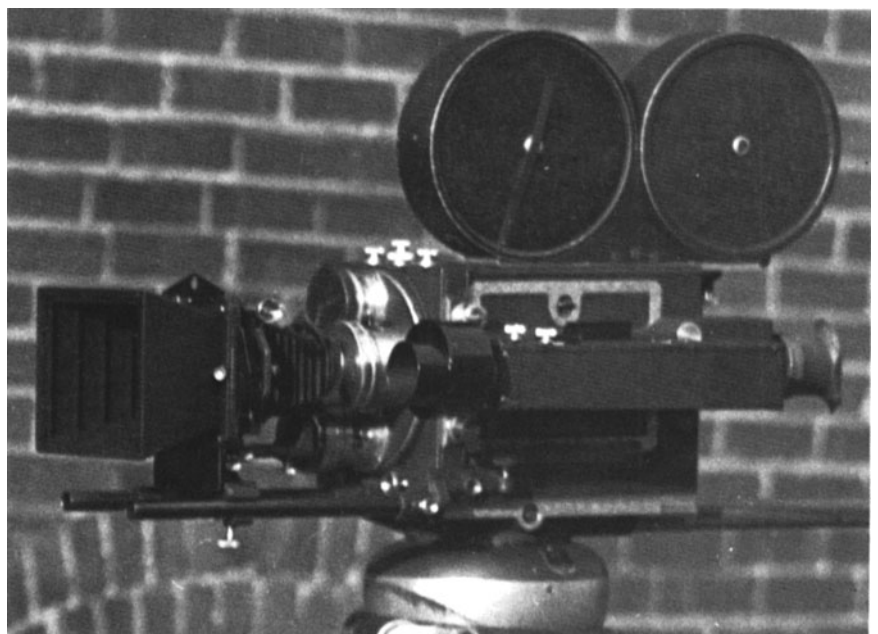


Figure 12. Standard *Mitchell* camera of 1920.