BELL & HOWELL COMPANY

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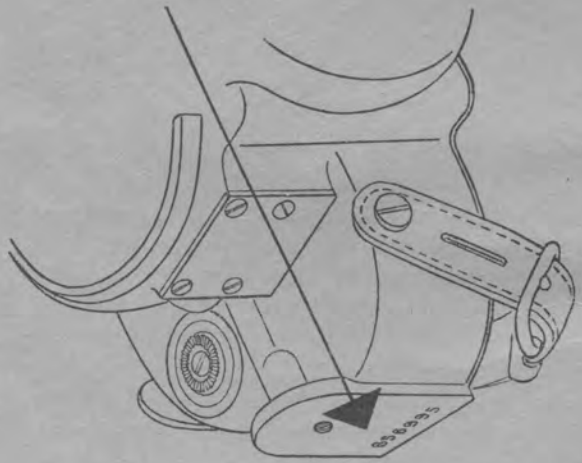
How to use your BELL & HOWELL 70-DA, -DE, -G or -H 16mm camera

IMPORTANT

The Bell & Howell Lifetime Guarantee is VOID unless you register the serial number of your equipment with Bell & Howell. Use the stamped self-addressed reply card over this cover. Registration of your equipment brings you the following advantages:

1. Obtaining the full benefits of the B&H Lifetime Guarantee.
2. Assistance in finding your equipment in case of loss or theft.
3. Free correspondence counsel from our Personal Service Department.
4. Receipt of bulletins about movie equipment and its use.

Use the stamped registration card over the booklet cover to register your equipment with Bell & Howell—mail it *today!* The serial number of your 70 camera will be found on the camera base near the tripod socket, as illustrated below.



Congratulations!

You have purchased a promise with your B&H camera —a Bell & Howell promise of professional "movies" with amateur ease for years to come.

Behind this promise and your camera stand years of Bell & Howell research, tireless craftsmanship of engineers and workmen, and the finest materials made. To be sure you get the perfect pictures your Bell & Howell equipment is made to give, study the following pages carefully with your camera in front of you. Then, when you put it to work, you'll get matchless performance from your very first try.

We designed your camera with an eye to technical improvements yet to come. So that you will never lose your original investment, we gave it a far-sighted basic design—a built-in capacity to keep pace with modern developments. Later, to make your camera as up-to-date as the newest one on your dealer's shelf, you simply incorporate the improvements in your sturdy camera.

The sharp, steady pictures you get—in full, natural color or sparkling black-and-white—are proof of Bell & Howell superiority. Matched registration mechanisms of B&H cameras and projectors and precision manufacturing from start to finished product give you perfect results —over a long lifetime.

Please feel free to call on your Bell & Howell dealer or write directly to us for further information. We promise to stand behind our products—your purchases—through the years to come.

BELL & HOWELL COMPANY
7100 McCormick Road
Chicago 45, Illinois

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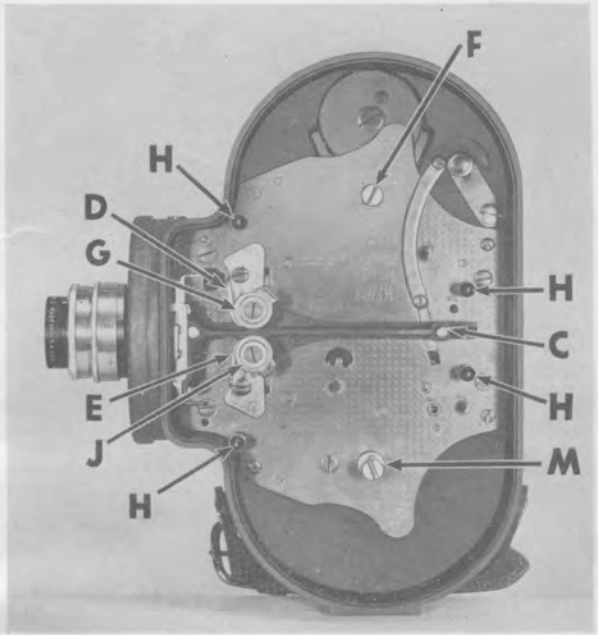


Figure 1

Your guide for locating interior parts referred to in the instructions

C. Film gate arm
D. Upper film guide shoe
E. Lower film guide shoe
F. Feed spool spindle
G. Feed sprocket
H. Floating film guard rollers
J. Take-up sprocket
M. Take-up spool spindle

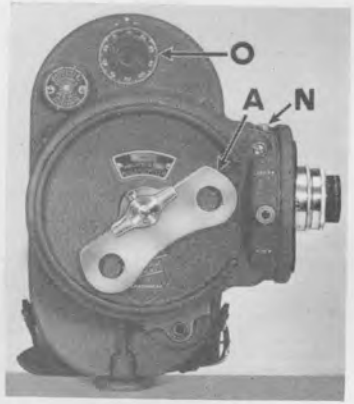


Figure 2

A. Winding key (Arrow shows turning direction for winding.)

N. Starting button

O. Footage dial

Loading the Camera.

Wind the spring motor by turning the ratchet winding key A, Figure 2, to the left (counter-clockwise) until it stops (do not force it).

Open the camera by turning together the two cover latches, on the viewfinder side, one-quarter turn until the handle points to the word "Open," when the cover may be lifted off by grasping the viewfinder.

Open film gate by pushing gate arm C, Figure 3, toward the back of camera as far as it will go. An intermediate stopping point is reached when the gate is open, but the gate arm should be pushed on back until the upper and

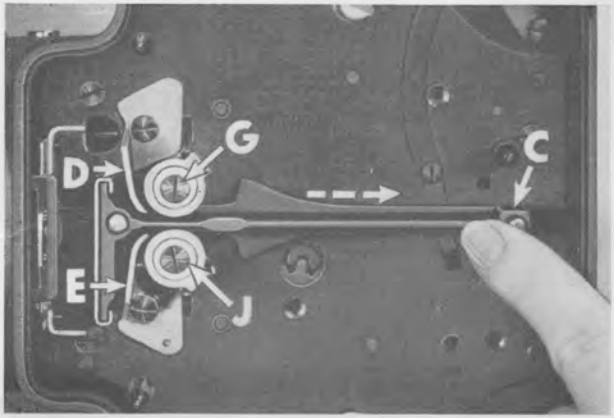


Figure 3
Opening the film gate

C. Film gate arm
D. Upper film guide shoe
E. Lower film guide shoe
G. Feed sprocket
J. Take-up sprocket

lower sprockets, G and J, are drawn away from their guide shoes—D and E, as in Figure 3.

Note: While the camera may be safely loaded and unloaded in daylight, always avoid direct sunlight.

Remove a spool of film from its metal container. Unreel about 18 inches of the leader film. *The first 6 feet of the film itself serve for threading and as a light-proof protective leader.* During this and all succeeding operations, keep the leader wound tightly. If it is permitted to loosen, light may be admitted which will fog the film on its edges.

With the square hole down (on B&H and Ansco spools *only*) and the leader feeding off the *bottom* of the spool to

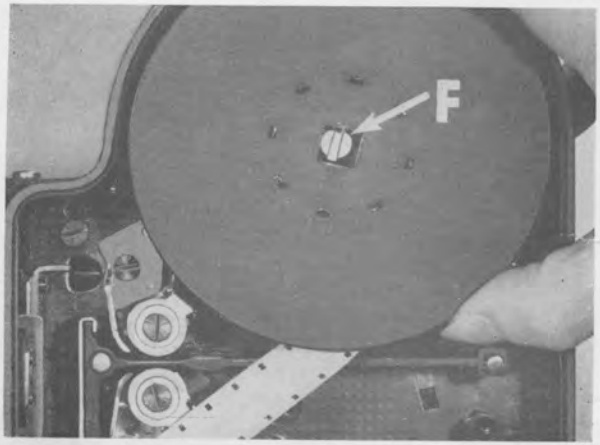


Figure 4

Inserting the feed spool over the feed spool spindle, F

the left, as shown in Figure 4, place the spool over the feed spool spindle F, Figure 4. Be sure that the two floating film guard rollers H, Figure 5, are outside the film.

Insert the leader between the gate arm C and the feed sprocket G, passing it also between the feed sprocket and the upper film guide shoe D, as shown in Figure 5. See that the leader perforations are engaged with the sprocket teeth.

Place the leader in the film gate channel, as in Figure 6, leaving enough slack above to form the upper loop, the extreme top of which should be about ¼ inch from the metal camera shell.

Leaving a lower loop of about the same size as the

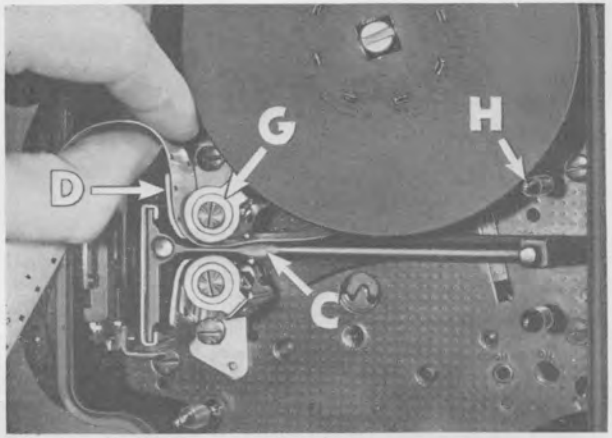


Figure 5

Threading film leader around the feed sprocket

C. Film gate arm **G. Feed sprocket**
D. Upper film guide shoe **H. Floating film guard rollers**

upper loop, insert the leader between the take-up sprocket J and the lower film guide shoe E, as shown in Figure 7. Engage the sprocket teeth with the perforations in the leader.

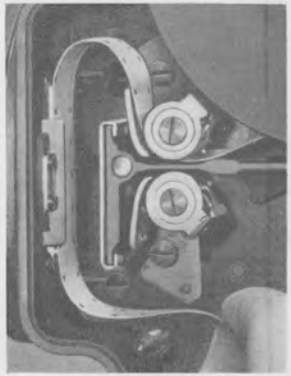


Figure 6

Inserting film leader in film gate channel

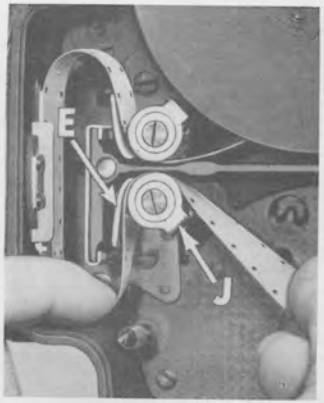


Figure 7

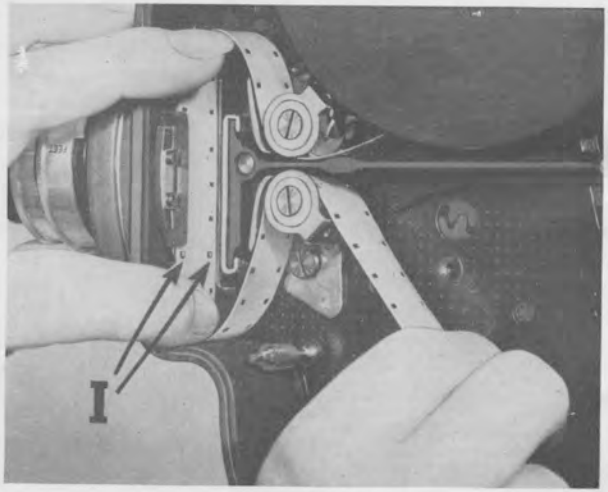
Threading film leader around the take-up sprocket

E. Lower film guide shoe

J. Take-up sprocket

Figure 8

Engaging leader perforations with the two shuttle teeth, I



Inspect the upper and lower film loops, K and L, Figure 9. They should be of the size shown, their extremities being about ¼ inch from the metal camera shell. Correct their size if necessary by drawing the film forward or backward over the lower sprocket.

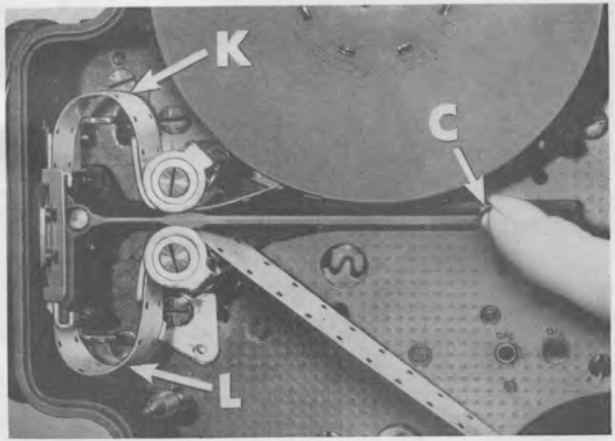
Engage a pair of perforations with the two shuttle teeth I, Figure 8, at the bottom of the aperture plate.

Make sure that the leader perforations are still engaged with the teeth of both feed and take-up sprockets and with the shuttle teeth and that the loops are still of the size described above. Then close the film gate by pushing the film gate arm C forward as far as it will go. Be careful not to stop at the intermediate point. The gate

Figure 9

Closing the film gate with gate arm, C

K and L. Correct sized upper and lower loops, respectively



should be pushed up snugly against the film. This operation is shown just completed in Figure 9.

A final check of the film loop size should now be made. Seven pairs of perforations should be visible in the upper loop, six pairs in the lower loop, when the film gate is closed.

Insert the end of the leader in the take-up spool hub slot, as shown in Figure 10. (When using an Eastman Kodak spool, place the side with the square hole toward the inside of the camera.) Revolve the spool to the right (clockwise) to take up the slack. Then place over the take-up spindle M, Figure 11.

Figure 10
Inserting film leader end in spool hub slot

Test correctness of the loading and threading by pressing starting button N, Figure 2, quickly and momentarily a few times, watching to see that the leader runs through the sprockets and aperture channel and that it is being taken up by the take-up spool. Correct any errors which are discovered by this test.

Avoid running off over 6 inches of film in testing. This, with the 18 inches used in threading and the 4 feet to be run off with the camera cover in place, comprises the 6 feet which is cut off the roll (as leader) in the processing station.

Replace the camera cover. It will not go on unless the gate arm C is fully closed. Turn the latches a quarter turn to the "closed" position. The camera should not be opened again, except in a darkroom, until the entire reel has been exposed.

NOTE: *Save the carton in which the film is purchased, as well as the metal container. These are used for mailing the exposed film to the laboratory for developing.*

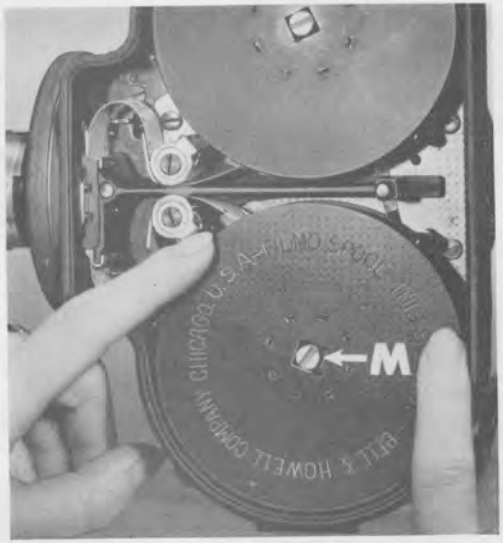


Figure 11
Inserting the take-up spool

Set the footage dial O, Figure 2, at 96 by turning it with the thumb and finger. Start the camera and let it run until the footage dial registers zero. This is done to run through the four feet of leader which was left on the feed spool when you closed the camera. The film itself is now at the aperture and your camera is ready for use.

Unloading the Camera

After the entire 100-foot roll of film has been exposed (as indicated by the footage dial having made a complete revolution and registering zero again) there remains on the

feed spool approximately five feet of trailer. This must be run through the camera mechanism before removing camera cover. Press the starting button, allowing the camera to run until the dial turns a little past the six-foot mark. This gives assurance that the trailer has enclosed the exposed film, protecting it from the light admitted when the cover is removed.

It is a wise precaution to avoid direct sunlight when unloading the camera. Take the exposed spool out carefully, pressing on the trailer to prevent any tendency to unwind or loosen. Place the spool in the safety metal container in which it was received, insert this in the cardboard carton, and send to nearest Film Developing Station (see address on card in film carton).

Special Precautions

Some 70 camera users prefer to give their films additional protection from the light during the loading operation by leaving the inner of the two metal covers (which comprise the container) over the spool as it is placed in the camera and until the threading is completed through step 11.

An almost indispensable precaution is to test the take-up spool with the B&H spool gauge (which is supplied with each camera) to see that the spool flanges are not spread or compressed. Spread or compress the flanges as necessary with your fingers until the gauge shows that you have corrected the difficulty.

Winding the Motor. Wind the spring motor by turning the ratchet winding key to the left (counter-clockwise) until it becomes tight. If the key is nested in the palm of the right hand while the left hand holds the camera, the camera itself may be turned one way while the key is turned the other, thus speeding up the operation. Due to the

ratchet, the same backward and forward motion may be used that is employed in winding a watch. After winding, fold the key flat against the side of the camera. If left erect it will rotate as the camera runs.

The 70 camera motor has a capacity of 22 feet of film per winding. It is advisable to wind after each scene, as this practice gives assurance of always having ample power for an emergency or long scene.

It is not necessary to remove the winding key from the camera during normal operation, since the key folds flat against the camera when not in use. In the event it is necessary to remove the key, hold the camera firmly in one hand and pull the key off the spring motor shaft. If the key fits the shaft too tightly, slip the end of a screw driver beneath key handle at hinge in key and exert a slight pressure. To replace the key, place it over shaft and press firmly down into place.

Speed Adjustment Dial. The 70 camera speed adjustment dial is illustrated in Figure 12. Any one of seven speeds (8, 12, 16, 24, 32, 48, and 64 exposures per second) may be selected.

Notice that the outer knurled ring revolves about the disc upon which these seven speeds are indicated. To obtain the 8, 16, 32, or 64 speed, turn the outer knurled ring until the upper index mark upon it coincides with the index dot on the edge of the segment in which the desired speed is designated.

Figure 12

Speed adjustment dial, shown set for normal (16) speed operation

To obtain the 12, 24, or 48 speed, use the lower index mark on the knurled ring, setting it opposite the desired speed index dot at the bottom of the numbered disc.

If the operating speed of the camera is to be changed while the equipment is operating, first turn the speed control dial to the next higher operating speed than that desired; then turn it back to the desired operating speed.

Intermediate speeds may be used since the variation from one speed to another is gradual and not confined to the markings of the speed control dial.

Use 16-speed for all normal purposes.

The slower speeds, 8 and 12, are useful for speeding up sluggish action and for gaining greater exposure through the slower shutter speeds (1/13 and 1/20 second respectively) when the light will not permit full exposure at your fastest lens opening at normal (16) speed with its 1/28 second shutter speed.

The faster speeds have innumerable uses. 64-speed gives a slow-motion effect, and is useful for golf stroke analysis movies and scenes analyzing form in any sport, as well as for analyzing and demonstrating machine operations. 48-speed is used to advantage for scenes from fast moving trains or automobiles. 24 and 32-speed are recommended for panoramic shots, as operation at these speeds minimizes irregular motions of the camera. Sport events, as football games and races, are better filmed at these speeds so that the eye can follow the action more easily. 24-speed should be regularly used if sound is to be added.

The 70-G camera operates at 128 frames per second only; no speed setting is possible or necessary.

See also the table of shutter speeds, page 35.

Single Frame Mechanism. You too, can enjoy the thrills of animation by taking single frame pictures with your series 70 camera. A light tap on the starting button will expose one frame of film. **Do not hold the button down,** but release it immediately after pressing it down,

otherwise the camera will be on continuous run. This is best accomplished by holding your arm steady and letting your wrist bend up and down vertically.

If you prefer a positive action single frame release the B&H Service Division can install the single frame device for you.

Lens Setting. Your camera will be equipped with a 1″ f/1.9 lens in focusing mount, unless otherwise ordered.

The use of lenses in focusing mounts calls for care in determining the distance of subjects from the camera before setting the focusing scale, but such lenses permit photographing subjects at distances less than 15 feet even at the larger apertures. The focusing ring on the lens is calibrated in feet, and this should be set to correspond to the distance between camera and subject. For all objects beyond the largest figure on the scale, the infinity setting should be used; distances falling between calibration marks may be estimated and the ring set accordingly.

The term *universal focus* is synonymous with *fixed focus*—which means that no adjustment is necessary to photograph subjects at varying distances from the camera, but which limits the shortest distance at which sharply focused pictures may be taken.

The near limit of good focus will come still closer towards the camera as the lens is stopped down. It will be seen later that the aperture at which the lens is worked cannot be determined arbitrarily, but that it is dictated by the prevailing light conditions.

The term *f/1.9* describes the relative area of the lens aperture through which light may pass to record an image upon the film. On examining the lens, you will notice that one ring bears the figures f/1.9, 2.8, 4, 5.6, 8, 11, 16, and 22. Turn the number bearing ring until f/1.9 falls opposite the

index mark. As this is done, you will notice that the metal leaves of an iris diaphragm within the lens open until, when the lens is set at f/1.9, they are expanded to the maximum. When the light on the subject to be photographed is weak, f/1.9 is the stop to use, because this iris opening admits as much light as possible through the lens to the film.

Now turn the ring (bearing the stop numbers) in the opposite direction, and watch the iris diaphragm close down until, at f/22, only a small opening remains. This is the lens stop to use when the light is unusually strong.

(Since the diaphragm ring may turn farther than the f/22 position, it is essential that, when pictures are to be made at this setting, the number 22 on the lens diaphragm ring be accurately lined up with the index mark.)

Turning back from f/22 to f/1.9, remember that each stop gives twice the exposure (admits twice as much light) as the preceding stop: f/16 gives twice the exposure of f/22, f/11 gives twice the exposure of f/16, etc. (In inverse ratio to the square of the stop number.) Notice that turning to a smaller number allows more, not less, light to pass through the lens.

A thorough study of the tables appearing at the back of this instruction book will help you make the best possible use of the lens, or lenses, with which your camera is equipped.

Figure 13

The correct way to hold the 70 camera

How to Hold the Camera. The position in which the camera is most advantageously held is shown in Figure 13. Steady it by pressing it firmly against the forehead, bringing

the *left* eye even with the viewfinder to avoid "squinting." Keep the arms close to the body, forming as rigid a rest or support for the camera as possible. It is very important to hold the camera steadily.

When using telephoto lenses, it is well to employ a tripod, as any slight movement of the camera is exaggerated in projection. The camera base is tapped for mounting on a tripod.

Turret Head on 70-DA, -DE, and -H. One to three lenses may be mounted upon the turret head. If less than three lenses are purchased with the camera, the remaining openings in the camera head are closed with

LENS COMBINATIONS

which can be mounted on the 70-DA camera turret head without interference by the longer lenses with the fields of the shorter lenses.

Shortest lens on turret	B&H lenses which may be used on 70-DA turret with shorter lenses listed at left. Lenses in these columns are to be focused on infinity (which reduces their length to the minimum).						
0.7" f/2.5	1" f/1.9	2" f/1.4†	2" f/3.5*	2.8" T2.5*	3" f/4	4" f/4.5*	
1" f/1.9		2" f/1.4	2" f/3.5	2.8" T2.5*	3" f/4	4" f/4.5	
2" f/1.4			2" f/3.5	2.8" T2.5*	3" f/4	4" f/4.5	
2" f/3.5				2.8" T2.5*	3" f/4	4" f/4.5	6" f/4.5
2.8" T2.5					3" f/4	4" f/4.5	6" f/4.5‡
3" f/4						4" f/4.5	6" f/4.5
4" f/4.5							6" f/4.5

‡Telate only.
†With 2.8" T2.5 lens removed.
*With sunshade and/or filter removed.

metal caps. These caps may be unscrewed and additional lenses screwed in at any time.

The 1″ f/1.9 foc. mt. lens is recommended for general use, regardless of which two optional lenses may be selected. This lens is the one to use for the usual run of scenes. It produces clear, sharp pictures of good depth, and is of sufficiently short focal length so that rock-steady pictures may be made with it by using reasonable care in holding the camera in the hands.

When it is desired to turn the turret to take a scene through another lens, grasp the edge of the head and revolve it in either direction until the desired lens is in position. An audible click tells when the lens is properly seated. *The starting button is automatically locked until a lens is correctly seated* —a feature which saves film and disapointments.

Lens Combinations. Any lens listed on page 17 may be used upon the 70 camera turret head, and fine combinations for every type of work may be mounted simultaneously. However, certain combinations cannot be used together because of interference with the field of the wider angle lenses. This chart specifies which lenses may be used together without interference.

Viewfinder—Spyglass, or Turret Type. The area seen through the viewfinder corresponds exactly with the field included by the camera lens. As the image is clearly, sharply seen in an upright position, it is very easy to follow moving objects with the viewfinder, and to arrange the composition of your scenes for the most beautiful effects.

As the viewfinder is located 1¼ inches to the side of the lens, it is necessary, when filming objects with a 1″ lens at a distance of five feet or less from the camera, to make a corresponding allowance in the horizontal position of the camera to compensate for this parallax by aiming 1¼″ to the

left of the center of the object.

With telephoto lenses this minimum distance will increase in proportion to the focal length of the lens used. A 2″ lens will require parallax compensation for all subjects ten feet or less from the camera, a 3″ lens at 15 feet or less, a 4″ at 20 feet or less, and a 6″ at 30 feet or less. When the subject is further away than the minimum distance, no allowance for the offset need be made.

Figure 14
The spyglass viewfinder, with the dial set for showing the field included by one-inch lens

To set the **spyglass viewfinder** revolve the viewfinder dial (Figure 14) in either direction until the figure corresponding to the focal length of the lens to be used coincides with the index mark on the viewfinder tube just in front of the dial. This action locates, within the viewfinder tube, a rectangle which restricts the angle of view through the viewfinder to exactly that of the photographic lens. The "20" means 20mm; others are inches.

If your camera is equipped with a **positive viewfinder turret,** purchase an objective lens to match each supplementary lens you own. These matched objectives, after being positioned according to the lens to be used, show a full size

Figure 15
Positive viewfinder turret

image of the area to be photographed by the camera lens, making unnecessary the use of masks for telephoto lenses.

Mount each objective on the viewfinder turret in a position corresponding to that of the lens it matches. For example, reading clockwise, the lenses on the camera turret are the 1″, 2″ and 4″; therefore, the objectives, reading clockwise, should be the 1″, 2″ and 4″.

To position the objective before the viewfinder aperture, rotate the turret until the objective matching the focal length of the lens in use is before the aperture. The turret clicks into each of the three positions to correctly position the objective.

Starting Button. When the camera is loaded, wound, and properly held, and when the turret head and lens diaphragm are properly set and the subject is framed in the viewfinder, it is only necessary to press the starting button N, Figure 16, to begin taking motion pictures.

As soon as the button is pressed the hum of the motor will tell you that the camera is in operation. Maintain pressure on the button until you wish to conclude the scene, then release it. To keep the camera in operation when the finger is removed from the starting button, press the lock pin in when the starting button is depressed. This permits the operator to step into the picture. To stop the camera mechanism, withdraw the lock pin, allowing the starting button to rise.

Figure 16
N. Starting button and run control. B. Starting button lock

The starting button may be locked, if desired, to prevent

accidental starting of the camera. Revolve the turret so that any one of the three index marks on the edge of the turret head falls opposite the word "Lock", (Figure 16) on the camera proper. To release, turn the turret until the desired lens is at the aperture, when an index mark will fall opposite the word "Run."

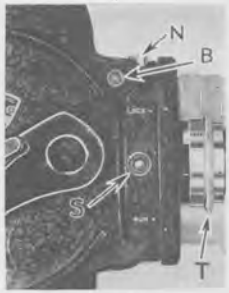


Figure 17
N. Starting button lock and run control. S. Critical focuser eyepiece. T. Lens in position for focusing. B. Starting button control.

Critical Focuser. Revolve the turret head until the lens to be focused clicks into the position of the lens T, in Figure 17. Then point the camera to the object you desire to photograph and sight through the eyepiece S, Figure 17. If you hold the camera with the top up or have it on a tripod you will see, in a circular field, an inverted and greatly magnified image of the central portion of your subject. If you find it more convenient, hold camera on its side; the image will then be right side up but reversed from left to right.

Focusing is done by manipulating the focusing ring of the lens mount in the usual way. It is customary to focus with the lens wide open, then stop down as necessary before filming. Look at the ground glass. Then focus the lens so that the subject image is also sharp. It often helps to turn the lens focusing ring slowly until the point of greatest image sharpness has been passed, then reverse the turning action until you find the point at which the lens is most critically focused. With very little practice, this method eliminates the possibility of any error in judging when the lens is set at its best focus.

After focusing, set the lens in photographic position by turning the turret half a revolution, and proceed to take your picture.

Remember that the Critical Focuser is to be used only for focusing and not for composing the picture. Use the viewfinder for this purpose.

The lens, when in focusing position, is approximately two inches to the right of its photographing position. The B&H Focusing Alignment Gauge, a tripod accessory, provides means for accurately shifting the camera to the left for critical focusing, or to the right for centering the subject in the viewfinder.

An important feature of the 70 camera design is this—when the lens is in critical focusing position the starting button of the camera is automatically locked, eliminating all possibility of neglecting to set the lens in its proper photographing position after focusing.

Length of Scenes. A common tendency, when first starting to use a moving picture camera, is to cut the scenes too short—that is, to fail to keep the camera operating long enough on each subject. As a result the scenes, when projected, flash on and off the screen too quickly for the eyes of the audience to grasp the image. Four feet can be considered an average minimum footage for such scenes as close-ups of people, scenics, or any action which is continuous but not changing in nature.

If action is changing, more than four feet of film may be required to tell the story. Ordinarily, the camera should be started just before the action begins and stopped just after the action ends.

While filming, counting seconds is the commonly used guide. Four feet of film are exposed in ten seconds of

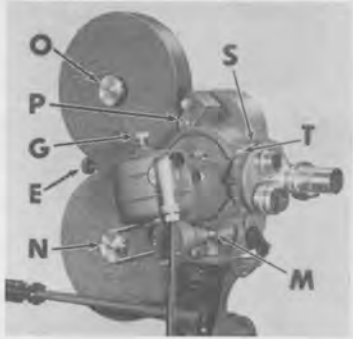
normal speed operation. After the scene is filmed the footage dial may be consulted to check up on the accuracy of your counting.

Hand Crank and Rewind Knob. Before beginning to backwind with the hand crank, be sure to place a lens cap or other suitable cover over the lens to avoid exposing the film while it is being backwound. If your camera is equipped with electric motor drive and magazine equipment, slip the belt off the take-up pulley N, Figure 18, and remove electric motor.

While holding the crank firmly in position to prevent forward movement of the film, press the starting button. Hold it down, or lock it down with the starting button lock, and turn the hand crank in a counter-clockwise direction (against

Figure 18

E. Magazine attaching screw
G. Motor hand turning knob
M. Motor shaft and hand crank socket
N. Magazine take-up pulley
O. Magazine feed pulley
P. Camera speed control dial
S. Starting button
T. Starting button lock



the spring pressure). Release the starting button, or unlock it, before releasing the crank at the end of the backwind.

Each revolution of the hand crank moves 20 frames of film (one-half foot) past the aperture. This is indicated by the calibrated crank dial which can be revolved independently

of the hand crank and be initially set at zero, regardless of the position of the crank, itself. **Backwinding should be limited to one foot of film if the camera is equipped with a hand crank only. With a hand crank and upper rewind knob,** you may backwind two feet of film; **with hand crank, upper and lower rewind knobs,** you may backwind as far as the spring motor is unwound.

To take up film on the feed spool, press the upper rewind knob inward to engage it with the feed spool, and revolve it in a counter-clockwise direction. It is important not to force the turning, or the film may be torn or damaged. It is best to turn the hand crank two revolutions and then use the upper rewind knob to take up the film on the feed spool, repeating this action as necessary to wind back the desired film footage. If the camera is equipped with electric motor drive and magazine equipment, while moving film backward with the hand crank, insert a finger in one of the holes in the upper feed pulley O, Figure 18, and turn crank clockwise to take up film on the spool or hub.

When making a number of lap-dissolves in a single roll of film, it is desirable to have two backwind knobs installed on the camera door, one for each spindle, so that the film can be kept tightly wound on each spool, and any possibility of film jamming completely eliminated.

CAUTION: Wind the film back before winding the camera main spring. The camera cannot be cranked backwards when the main spring is fully wound.

Footage Dial. The camera footage dial, which is directly coupled to the camera mechanism, moves forward as the hand crank is turned in reverse. After reversing, set the footage dial back twice the number of feet rewound. Briefly, set the dial back one foot for each backward revolution of the hand crank.

Double Exposure. To make a simple double exposure, in which the same length of film is exposed twice, make the first picture and then place the lens cap on the lens and back up the film with the hand crank. After the film has been backwound it is again exposed, superimposing the two pictures.

Straight double exposures permit title tricks such as the superimposition of the letters on moving backgrounds, and also unusual effects in ordinary filming. Remember that a dull black background reflects no light and that, consequently, if part of the scene first exposed consists of such a background, no pictures will appear on that part of the frame. The emulsion as yet has recorded no image. If you rewind and expose again, removing the black background, this second object will appear on the film along with the subject filmed in the first exposure.

All double-exposed titles require the use of a tripod for both exposures.

Fades. As the name implies, a fade-in starts at the beginning of the scene with solid black and gradually becomes lighter until a picture of normal brightness is reached. A fade-out comes at the end of the scene, and means that the picture becomes darker until it is totally blacked out.

Fading is accomplished by closing or opening the lens diaphragm. Neutral density filters may be used to permit shooting the picture at a larger lens diaphragm opening and thus to obtain a larger range of diaphragm movement for making the fade. The neutral density filter does not affect the color of color films nor does it have any effect on the black and white rendering. To make a fade-in with the lens diaphragm, first set the lens diaphragm to its smallest opening, place a finger on the end of the lens shade and start the camera. Remove your finger after a few frames have been exposed and then slowly revolve the diaphragm

ring until it reaches the setting for the correct exposure of the scene being photographed. When ready to stop shooting the scene, slowly turn diaphragm ring to close it. Place a finger over end of lens and, after three or four frames, stop the camera.

Lap-dissolves. A lap-dissolve is a transition from one scene to another where the first scene melts gradually and almost imperceptibly into the second. It is accomplished by superimposing a fade-in over a fade-out.

To make a lap-dissolve, stop the camera at the full fade-out position, about four seconds being used for the fade-out. Then, with the lens cap in place, rewind for two and one-half revolutions of the hand crank. When the second scene has been decided upon, start the camera and fade-in at the same time, keeping the camera running after completing the fade-in for the duration of the scene. Be sure that the lens cap is removed and that the diaphragm is closed as far as it will go before filming the second scene.

Use the same length of time for the fade-in as for the fade-out.

When lap-dissolves are made by fading in and out with the lens diaphragm, a tripod is essential, since you cannot look through the viewfinder and adjust the diaphragm at the same time.

Lubrication. B&H 70 cameras require adequate lubrication. Five oil holes are provided, one at the center of the head (Figure 19) and four in the plate beneath the film spools (Figure 20). To get at the oil hole on the camera head, pry out the capped pin which plugs

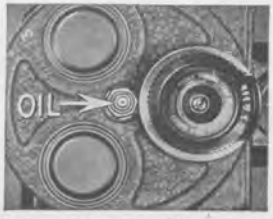


Figure 19

this hole, using a pen knife or a small screw driver. Each of the five holes should receive one or two drops of B&H Camera Oil after each five or six hundred feet of film are exposed. Should the camera remain unused for a month or more, oil it before using it. Oiling is particularly necessary when the camera is used in humid countries or by the sea. (If the camera has a hand crank, another oil hole near the hand crank hole should also receive one or two drops of lubricant at each oiling.)

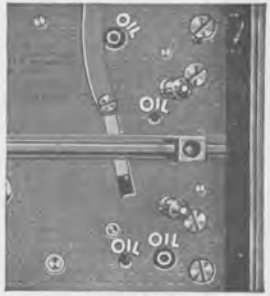


Figure 20

Cleaning Lenses and Viewfinders. Lenses should be kept scrupulously clean at all times. *Do not take them apart.* Clean frequently the exposed glass surfaces at the front and back to remove all dust, dirt, lint, or finger prints. To avoid damaging the highly polished glass surfaces, use B&H lens cleaning fluid and lens cleaning tissue. Clean Filmocoted lenses with B&H lens cleaning fluid *only*. Color filters should receive the same attention as lenses.

Dirt on the viewfinder lenses should also be removed with lens tissue so that clear vision will always be had.

Cleaning Aperture Plate and Film Gate. The aperture plate and the back plate (Q and R respectively, Figure 21) should be inspected frequently and cleaned if any dirt or film emulsion has collected upon them. Their smooth, highly polished surface must be maintained if the best results are to be obtained. Wipe with a clean, dry, soft cloth; *use no sharp tools!* If emulsion accumulations re-

main, remove them with a moistened toothpick. Clean the upper and lower film guides (D and E, Figure 21 in the) same way.

Wipe the inside of camera. Keep it free from dust.

Figure 21
Q—aperture plate, R—back plate, D and E—upper and lower film guide shoes

70-G Superspeed Camera

The 70 camera is also built in a superspeed model (70-G) operating at one speed only—128 exposures per second, which is eight times normal speed. This camera produces the true s-l-o-w motion effect, and is used primarily for motion analysis work. The superspeed camera is operated in the same manner as other 70 cameras *with the following exceptions:*

Threading. The shuttle teeth of the superspeed instrument are not always in the same position when the mechanism is stopped. Sometimes, in threading the camera, it will be found that the shuttle teeth do not project through the slots in the aperture plate. In order to engage the film perforations properly on the shuttle teeth, it is necessary that these teeth project through the aperture plate. If the starting button is tapped lightly, the shuttle teeth will appear through the aperture slots, thus allowing proper engagement of the film perforations. It is advisable to stop

the shuttle with the teeth at the lower ends of the slots, as this assists in the formation of film loops of the correct size.

IMPORTANT! FIVE perforations should be visible in each loop, instead of six in the lower, and seven in the upper loop, as in the regular 70 cameras.

Operation. The superspeed camera exposes 16 feet of film when it is fully wound. Although only five seconds are required to expose this footage, it should be remembered that forty seconds will be required to run this length of film through a projector operating at normal speed, 16 pictures per second. It is important to wind the camera fully after each scene has been photographed, to insure having sufficient spring power for the next scene.

Lens Adjustment. To compensate for the shorter exposure which each individual picture receives when the film is run at 128 pictures per second, it is necessary to open the camera lens three full stops (moving the calibrated diaphragm adjusting ring in the direction of the smaller numbers of the diaphragm scale). Example: When f/11 would give correct exposure at normal (16) speed, set the 128-speed camera lens at f/4.

Cleaning and Lubrication. Clean the aperture plate and film gate after every roll of film, following the procedure outlined on page 27. Also follow the lubrication instructions on page 26, but oil the camera after every 200 feet of film have been exposed, instead of after every five or six hundred feet.

Electric Motor Drive and Magazine Equipment for 70-H Camera

Attaching the Motor. The spring motor of the camera should preferably be run down before attaching the

electric motor or using the hand crank. Lock the starting button S, Figure 18, in operating position by pushing button down as far as possible and engaging locking pin T, Figure 18. Test by turning the spring winding key half a turn. The camera mechanism should operate as soon as the winding key is released if the starting button is properly locked.

To attach the electric motor, insert the main motor shaft and the motor support shaft into their respective sockets.

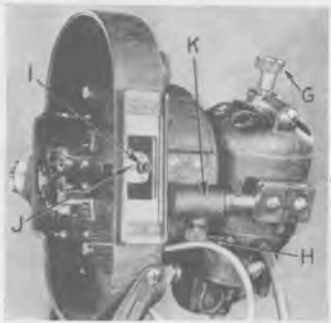


Figure 22

G. Motor hand turning knob

H. Motor support locking screw

I. Magazine attaching screw socket

J. Magazine door lock control plunger

K. Motor support rod socket

Turn the motor knob G, Figure 22, by hand until the motor shaft engages with the camera mechanism. The motor will not slide into proper position until this engagement of slot and lug is made. When the slot is engaged, slide the motor as close to the camera as the shaft will permit. Then tighten the thumb screw H, Figure 22, below the motor supporting rod socket. Open the camera and turn the motor knob G, Figure 22, several times by hand, observing the camera sprockets, to be certain that motor drive shaft is properly engaged.

Operating with Motor. CAUTION: Never connect

the motor to any supply line until you are certain that the line voltage conforms with the specifications indicated on the motor name plate.

The starting button on the camera *must always be locked down before the motor is started*. Use the calibrated control P, Figure 21, to set the camera speed; *this must be set above 24 speed for synchronous motor*. Start and stop camera with motor line switch.

Motor Lubrication and Care. After each 5,000 feet of film are run, place two drops of B&H camera oil in the two oil cups, located over each of the two main motor bearings. If the motor is used infrequently, place one drop of oil in each oil cup just before using.

Examine the motor brushes at regular intervals to make sure that they are not worn shorter than 3/16". They may be removed, on their springs, by unscrewing the bakelite screw caps. New brushes are available through your Bell & Howell dealer. Also, inspect and clean the motor commutator occasionally. To clean, place a piece of lintless cloth on the end of a stick and insert it through one of the four holes in the motor housing, holding it firmly in position against the commutator while turning the motor by the knob G, Figure 22. Never use emery cloth.

The reduction bearing of the motor is encased in grease. This grease packing will last for two years of regular service. Repacking should be done only through your Bell & Howell dealer.

Loading Magazines. An electric motor is necessary for magazine operation, as the spring motor is not so designed.

Lay the magazine flat with cover side up and valve, or flat, side toward you, as in Figures 23 and 24. Unscrew the cover discs by turning counter-clockwise. Attach the

loading clip as shown in Figures 23 and 24, to depress the plunger and hold the film valves open. This can be done in white light. Then in darkness, or with the aid of a suitable safe-light, open the film can. (200-foot rolls of 16mm film on daylight loading spools can be loaded in daylight. Avoid loading in bright sunlight.) The unexposed film is wound with the emulsion (dull) side in.

Unroll about 10 inches of film in a clockwise direction, pass the end to the right of the roller at the magazine aperture and out through the left-hand valve. Drop the spool or roll of film over the spindle. Film not purchased on daylight loading spools is used with a standard magazine hub instead. Loop the film, *emulsion side out*, and insert it through the right-hand valve and to the left of the roller, into the take-up chamber. Draw through, leaving a loop outside as shown in Figures 23 and 24, and attach the end to the take-up spool or hub. Drop the spool, or hub, over the right-hand spindle, and turn slowly in a counter-clockwise direction to take up slack. Check to see that the film is down snugly on the hub and will not contact the cover plates when they are screwed on. Now screw on the two cover plates, and remove the loading clip, thus closing the film valves.

Attachment of External Magazine. To attach the magazine, remove the cover plate on the back of the camera. (Figure 22 shows cover plate removed.) Hold loaded magazine near opening and slip film loop around the U-shaped plate which extends partly across the opening. Move the magazine into position against the camera and tighten thumb screw E, Figure 18, after engaging it with threaded socket I, Figure 22. Slip the spring belt over the magazine take-up pulley N, Figure 18.

Automatic Valve Action. When the camera door is

Figure 23
Correct method of loading magazine with film not supplied on daylight loading reels

Figure 24
Correct method of loading magazine using daylight loading spools. Loading clip is in position and feed spool about to be placed on spindle

replaced and the catches are turned to "closed," the plunger J, Figure 22, automatically opens the magazine valves, holding them open until the camera door catches are turned to "open" position. Free film passage is thus provided, and chances of abrasion or static eliminated.

Threading the Camera. Draw a sufficiently large loop from the *upper* magazine compartment to permit normal threading. Do not draw film from the lower take-up spool. Thread through the feed sprocket, film gate, and take-up sprocket in the customary way, testing correctness by turning the knob G, Figure 22, by hand, in a clockwise direction.

To use 100-foot spools of film in the camera without disconnecting the external magazine, remove the spring take-up belt by taking it apart at the joint. The belt can be easily replaced by inserting the end in the camera pulley hole and pushing it around the pulley and out the other side.

Operating with Spring Motor. With electric motor and magazine removed, and the cover plate replaced on the back of the camera, the 70 camera may be operated with either the spring motor or the hand crank. Do not attempt to use the magazine when operating camera with spring motor.

Veeder Footage Counter

The Veeder footage counter, replacing the manual footage counter, counts up to 1000 feet of film and may be reset to zero at any time.

Figure 25
V. Reset knob

When using the regular 100-foot internal loading spools, set the footage counter at "000" by turning reset knob V, Figure 25, counter-clockwise, run the camera until the counter registers "004," to run off the remainder of the leader film, and then reset the counter to "000." When the full 100 feet of film have been exposed, allow the camera to run until the counter registers past "106," to allow the film trailer to enclose the exposed film.

When using a 200- or 400-foot external magazine, set the counter at "000." Allow the camera to run until the counter registers "002" to run off the film exposed while threading the camera; then reset the counter to "000." When the full 200 or 400 feet of film have been exposed, allow the camera to run about another 2 feet; the end of the film will then have run through the camera and onto the take-up spool in the magazine.

Camera speed	Shutter speed
8	1/14 second
12	1/21 second
16	1/28 second
24	1/42 second
32	1/56 second
48	1/84 second
64	1/112 second
Single Frame	1/15 second

DATA TABLE FOR 16MM CAMERAS

with 1-inch lens in focusing mount

Object Area Ht.	Object Area Wd.	Best Focus	Far Depth Near	Far Limit, Depth of Field, Near Limit, and Limiting f/numbers									
				f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32
(16°)	(21°)	∞	N	60′	42′	30′	21′	15′	10′ 5″	7′ 5″	5′ 2″	3′ 9″	2′ 7″
5′ 7″	7′ 5″	20′	F	33′	38′	60′	420′	∞	∞	∞	∞	∞	∞
			D	15′	24′	48′	410′	∞	∞	∞	∞	∞	∞
			N	15′	14′	12′	10′ 3″	8′ 7″	6′11″	5′ 6″	4′ 2″	3′ 2″	2′ 4″
2′ 9″	3′ 8″	10′	F	12′	13′	15′	19′	30′	276′	∞	∞	∞	∞
			D	3′ 5″	4′11″	7′ 6″	12′ 3″	24′	271′	∞	∞	∞	∞
			N	8′ 7″	8′ 1″	7′ 6″	6′ 9″	6′	5′ 1″	4′ 4″	3′ 5″	3′ 9″	2′ 1″
1′ 11	2′ 7″	7′	F	7′11″	8′ 5″	9′ 2″	10′ 6″	13′	21′	92′	∞	∞	∞
			D	1′ 8″	2′ 5″	3′ 5″	5′ 3″	8′ 3″	17′	89′	∞	∞	∞
			N	6′ 3″	6′	5′ 9″	5′ 3″	4′ 9″	4′ 2″	3′ 8″	3′	2′ 6″	1′11″
1′ 4″	1′ 10′	5′	F	5′ 6″	5′ 8″	6′	6′ 7″	7′ 6″	9′ 7″	14′	16′	∞	∞
			D	11″	1′ 2″	1′ 9″	2′ 7″	3′ 9″	6′ 2″	11′	13′	∞	∞
			N	4′ 7″	4′ 6″	4′ 3″	4′	3′ 9″	3′ 5″	3′	2′ 7″	2′ 2″	1′ 9″
1′ 1″	1′ 5″	4′	F	4′ 4″	4′ 5″	4′ 7″	4′11″	5′ 6″	6′ 6″	8′ 6″	17′	∞	∞
			D	7″	9″	1′ 1″	1′ 7″	2′ 4″	3′ 7″	5′11″	15′	∞	∞
			N	3′ 9″	3′ 8″	3′ 6″	3′ 4″	3′ 2″	2′11″	2′ 7″	2′ 3″	1′11″	1′ 7″
11″	1′ 3″	3′ 6″	F	3′ 9″	3′10″	4′	4′ 3″	4′ 7″	5′ 3″	6′ 6″	10′ 8″	46′	∞
			D	5″	7″	10″	1′ 3″	1′ 9″	2′ 8″	4′ 1″	8′ 7″	44′	∞
			N	3′ 4″	3′ 3″	3′ 2″	3′	2′10″	2′ 7″	2′ 5″	2′ 1″	1′10″	1′ 6″
10″	1′ 1″	3′	F	3′ 2″	3′ 3″	3′ 4″	3′ 6″	3′ 9″	4′ 3″	5′	7′ 1″	14′ 5″	∞
			D	4″	5″	7″	10″	1′ 3″	1′11″	2′10″	5′ 2″	13′	∞
			N	2′10″	2′10″	2′ 9″	2′ 8″	2′ 6″	2′ 4″	2′ 2″	1′11″	1′ 8″	1′ 5″
8″	11″	2′ 8″	F	2′ 9″	2′10″	2′11″	3′ 1″	3′ 3″	3′ 7″	4′ 1″	5′ 6″	9′	∞
			D	2″	4″	6″	9″	1′	1′ 5″	2′ 1″	3′ 9″	7′ 5″	∞
			N	2′ 7″	2′ 6″	2′ 5″	2′ 4″	2′ 3″	2′ 2″	2′	1′ 9″	1′ 7″	1′ 4″
7″	10″	2′ 4″	F	2′ 5″	2′ 6″	2′ 7″	2′ 8″	2′ 9″	3′	3′ 5″	4′ 3″	6′ 1″	22′
			D	2″	3″	5″	7″	9″	1′ 1″	1′ 8″	2′ 8″	4′ 8″	21′
			N	2′ 3″	2′ 3″	2′ 2″	2′ 1″	2′	1′11″	1′ 9″	1′ 7″	1′ 5″	1′ 3″
6″	8″	2′	F	2′ 1″	2′ 1″	2′ 2″	2′ 3″	2′ 4″	2′ 6″	2′ 9″	3′ 3″	4′ 3″	8′ 7″
			D	2″	2″	4″	5″	7″	10″	1′ 2″	1′10″	2′11″	7′ 5″
			N	1′11″	1′11″	1′10″	1′10″	1′ 9″	1′ 8″	1′ 7″	1′ 5″	1′ 4″	1′ 2″
5″	7″	1′ 9″	F	1′10″	1′10″	1′10″	1′11″	2′	2′ 1″	2′ 3″	2′ 8″	3′ 3″	5′ 4″
			D	2″	2″	2″	4″	5″	7″	10″	1′ 4″	2′ 1″	4′ 3″
			N	1′ 8″	1′ 8″	1′ 8″	1′ 7″	1′ 7″	1′ 6″	1′ 5″	1′ 4″	1′ 2″	1′ 1″
4″	6″	1′ 6″	F	1′5.5″	1′ 7″	1′ 7″	1′ 7″	1′ 8″	1′ 9″	1′10″	2′ 1″	2′ 6″	3′ 6″
			D	1″	2″	2″	2″	4″	5″	7″	11″	1′ 5″	2′ 7″
			N	1′6.5″	1′ 5″	1′ 5″	1′ 5″	1′ 4″	1′ 4″	1′ 3″	1′ 2″	1′ 1″	11″

with 1-inch f/2.5 universal focus lens

Best Focus	f/number	f/2.5	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32
33′	Near Dist.	17′	15′	12′	10′	7′ 9″	6′ 2″	4′ 5″	3′ 4″	2′ 4″

SIZE OF PHOTOGRAPHED AREA (approx.) covered by Lenses for B&H 16mm Cameras
Note: For camera distances from 1 to 10 feet, read the following table direct. For greater distances, simply move decimal point. Example: Subject width for 1-inch lens on a 16mm camera is 2.22 feet at a distance of six feet. At sixty feet it would be 22.2 feet; at six hundred feet it would be 222 feet.

Lens Focal Length	Object Size in Feet for Various Object Distances											
	1′	2′	3′	4′	5′	6′	7′	8′	9′	10′	25′
0.5″*	0.54 0.72	1.10 1.47	1.66 2.22	2.22 2.98	2.78 3.73	3.34 4.48	3.90 5.23	4.46 5.98	5.02 6.74	5.58 7.49	13.98 18.77
0.7″	0.38 0.51	0.78 1.04	1.18 1.58	1.58 2.12	1.98 2.65	2.38 3.19	2.78 3.73	3.18 4.27	3.58 4.80	3.98 5.34	9.98 13.40
1″	0.26 0.34	0.54 0.72	0.82 1.10	1.10 1.47	1.38 1.85	1.65 2.22	1.94 2.60	2.22 2.98	2.50 3.35	2.78 3.73	6.98 9.37
1.5″	0.16 0.22	0.35 0.47	0.54 0.72	0.72 0.97	0.91 1.22	1.10 1.47	1.28 1.72	1.47 1.97	1.66 2.22	1.84 2.48	4.64 6.24
2″	0.12 0.16	0.26 0.34	0.40 0.53	0.54 0.72	0.68 0.91	0.82 1.10	0.96 1.28	1.10 1.47	1.24 1.66	1.38 1.85	3.48 4.67
3″	0.07 0.09	0.16 0.22	0.26 0.34	0.35 0.47	0.44 0.60	0.54 0.72	0.63 0.85	0.72 0.97	0.82 1.10	0.91 1.22	2.31 3.10
4″	0.05 0.06	0.12 0.16	0.19 0.25	0.26 0.34	0.33 0.44	0.40 0.53	0.47 0.63	0.54 0.72	0.61 0.81	0.68 0.91	1.73 2.32
6″	0.02 0.03	0.07 0.09	0.12 0.16	0.16 0.22	0.21 0.28	0.26 0.34	0.30 0.41	0.35 0.47	0.40 0.53	0.44 0.60	1.14 1.54

Upper dimension is height of picture. Lower dimension is width of picture.

*1″ lens with Wide Angle Attachment

THE HYPERFOCAL DISTANCE is the minimum distance at which critical sharpness is obtained with a given diaphragm opening when the lens is focused at infinity. When a focusing lens is set at the hyperfocal distance, all objects at half the hyperfocal distance and beyond will be in focus. The table below shows the hyperfocal distances for lenses for B&H 16mm cameras, expressed in feet and based upon a circle of confusion of 0.001″ diameter. When used with U.F.H. lenses (universal focus, hyperfocal distance), the following table gives the distance of best focus corresponding to the full aperture of the lens; objects more than half this distance away will be in focus for all f/settings.

Lens Focal Length	Hyperfocal Distance in Feet for Various Apertures													
	f/1.4	f/1.5	f/1.9	f/2	f/2.5	f/2.7	f/3.5	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32
0.5″*	14.9	13.9	11.0	10.4	8.3	7.7	6.0	5.2	3.7	2.6	1.9	1.3	1.0	0.6
0.7″	29.2	27.2	21.5	20.4	16.3	15.1	11.7	10.2	7.3	5.1	3.7	2.6	1.9	1.3
1″	59.5	55.6	43.9	41.7	33.3	30.9	23.8	20.8	14.9	10.4	7.6	5.2	3.8	2.6
1.5″	133.9	125.0	98.7	93.8	75.0	69.4	53.6	46.9	33.5	23.4	17.0	11.7	8.5	5.8
2″	238.1	222.2	175.4	166.7	133.3	123.5	95.2	83.3	59.5	41.7	30.3	20.8	15.2	10.4
3″	535.7	500.0	394.7	375.0	300.0	277.8	214.3	187.5	133.9	93.8	68.2	46.9	34.1	23.4
4″	952.4	888.9	701.8	666.7	533.3	493.8	381.0	333.3	238.1	166.7	121.2	83.3	60.6	41.7
6″	2142.9	2000.0	1579.0	1500.0	1200.0	1111.1	857.1	750.0	535.7	375.0	272.7	187.5	136.4	93.8

*1″ lens with Wide Angle Attachment

DEPTH OF FIELD TABLE FOR 0.7″ 16MM CAMERA LENS

Object Area		Best Focus	Far Limit, Near Limit and Limiting f/Numbers									
Ht.	Wd.		Far Near	f/2.5	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32
5′ 9″	7′ 9″	15′	F	140′	∞	∞	∞	∞	∞	∞	∞	∞
			N	7′ 11″	7′ 6″	6′ 2″	5′	3′ 11″	3′	2′ 3″	1′ 8″	1′ 2″
3′ 9″	5′ 3″	10′	F	24′ 8″	30′	21′	∞	∞	∞	∞	∞	∞
			N	6′ 3″	6′	5′ 2″	4′ 3″	3′ 5″	2′ 9″	2′ 1″	1′ 7″	1′ 2″
3′ 1″	4′ 2″	8′	F	15′ 5″	17′ 4″	34′ 8″	∞	∞	∞	∞	∞	∞
			N	5′ 5″	5′ 2″	4′ 6″	3′ 10″	3′ 2″	2′ 7″	2′	1′ 6″	1′ 1″
2′ 4″	3′ 1″	6′	F	9′ 5″	10′ 1″	14′ 3″	31′ 10″	∞	∞	∞	∞	∞
			N	4′ 5″	4′ 3″	3′ 10″	3′ 4″	2′ 9″	2′ 4″	1′ 10″	1′ 5″	1′ 0.8″
1′ 9″	2′ 6″	5′	F	7′ 2″	7′ 8″	9′ 8″	15′ 4″	138′	∞	∞	∞	∞
			N	3′ 10″	3′ 9″	3′ 4″	3′	2′ 7″	2′ 2″	1′ 8″	1′ 4″	1′ 0.4″
1′ 5″	2′ 1″	4′	F	5′ 3″	5′ 6″	6′ 6″	8′ 8″	17′ 4″	∞	∞	∞	∞
			N	3′ 3″	3′ 2″	2′ 11″	2′ 7″	2′ 3″	1′ 11″	1′ 7″	1′ 3″	11.8″
1′ 1″	1′ 5″	3′	F	3′ 8″	3′ 9″	4′ 2″	5′	7′ 1″	14′ 5″	∞	∞	∞
			N	2′ 6.5″	2′ 6″	2′ 4″	2′ 2″	1′ 11″	1′ 8″	1′ 5″	1′ 2″	10.9″
11″	1′ 3″	2′ 6″	F	2′ 1″	3′	3′ 3″	3′ 9″	4′ 10″	7′ 4″	59′ 8″	∞	∞
			N	2′ 2.1″	2′ 1.7″	2′	1′ 10″	1′ 8″	1′ 6″	1′ 3″	1′ 0.9″	10.3″
9″	1′	2′	F	2′ 3.3″	2′ 3.7″	2′ 6″	2′ 9″	3′ 3″	4′ 3″	8′ 8″	∞	∞
			N	1′ 9.4″	1′ 9.2″	1′ 8″	1′ 7″	1′ 5″	1′ 4″	1′ 2″	11.7″	9.5″
6″	9″	1′ 6″	F	1′ 7.8″	1′ 8″	1′ 9″	1′ 10″	2′ 1″	2′ 6″	3′ 6″	7′ 2″	∞
			N	1′ 4.5″	1′ 4.4″	1′ 3.7″	1′ 3″	1′ 2″	1′ 0.9″	11.4″	10.0″	8.4″
4″	5″	1′	F	1′ 0.77″	1′ 0.86″	1′ 1.3″	1′ 1.9″	1′ 3″	1′ 4″	1′ 8″	2′ 1″	4′ 4″
			N	11.32″	11.24″	10.9″	10.6″	10.1″	9.5″	8.7″	7.9″	6.8″
3″	4.5″	10″	F	10.53″	10.59″	10.87″	11.3″	11.9″	1′ 0.8″	1′ 2.7″	1′ 6″	2′ 5″
			N	9.52″	9.47″	9.26″	9.0″	8.6″	8.2″	7.6″	6.9″	6.1″
Hyperfocal Distance				16′ 8″	14′ 7″	10′ 2″	7′ 4″	5′ 1″	3′ 8″	2′ 7″	1′ 11″	1′ 4″

DEPTH OF FIELD TABLE FOR 2″ 16MM CAMERA LENS

Object Area		Best Focus		Far Limit, Near Limit and Limiting f/Numbers									
Ht.	Wd.		Far Near	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32
7′	9′ 3″	50′	F	63′ 2″	71′ 3″	86′	124′	305′	∞	∞	∞	∞	∞
			N	41′ 4″	38′ 6″	35′ 3″	31′ 4″	27′ 3″	22′ 10″	18′ 11″	14′ 9″	11′ 8″	8′ 8″
4′ 2″	4′ 6″	30′	F	34′ 3″	36′ 6″	40′	46′ 8″	60′	105′	195′	∞	∞	∞
			N	26′ 8″	25′ 6″	24′	22′ 1″	20′	17′ 6″	15′ 2″	12′ 4″	10′ 1″	7′ 9″
3′ 5″	4′ 6″	25′	F	27′ 11″	29′ 5″	31′ 8″	35′ 9″	43′ 2″	62′ 9″	144′	∞	∞	∞
			N	22′ 7″	21′ 9″	20′ 8″	19′ 3″	17′ 7″	15′ 7″	13′ 8″	11′ 4″	9′ 5″	7′ 4″
2′ 1″	2′ 8″	15′	F	16′	16′ 6″	17′ 2″	18′ 4″	20′ 1″	23′ 5″	29′ 9″	53′ 8″	180′	∞
			N	14′ 1″	13′ 9″	13′ 4″	12′ 8″	12′	11′	10′	8′ 9″	7′ 6″	6′ 2″
1′ 6″	2′ 2″	12′	F	12′ 8″	12′ 11″	13′ 4″	14′	15′	16′ 10″	19′ 10″	28′ 3″	57′ 6″	∞
			N	11′ 5″	11′ 2″	10′ 11″	10′ 6″	10′	9′ 4″	8′ 7″	7′ 7″	6′ 4″	5′ 7″
1′ 4″	1′ 8″	10′	F	10′ 5″	10′ 8″	10′ 11″	11′ 4″	12′	13′ 2″	14′ 11″	19′ 3″	29′ 6″	256′
			N	9′ 7″	9′ 5″	9′ 3″	8′ 11″	8′ 7″	8′ 1″	7′ 6″	6′ 9″	6′	5′ 1″
1′ 1″	1′ 4″	8′	F	8′ 3″	8′ 5″	8′ 7″	8′ 10″	9′ 3″	9′ 11″	10′ 10″	13′	16′ 11″	34′ 5″
			N	7′ 9″	7′ 8″	7′ 6″	7′ 4″	7′ 1″	6′ 8″	6′ 4″	5′ 9″	5′ 3″	4′ 6″
10″	1′ 1″	6′	F	6′ 2″	6′ 3″	6′ 4″	6′ 6″	6′ 8″	7′	7′ 6″	8′ 5″	9′ 11″	14′ 2″
			N	5′ 10.2″	5′ 9.5″	5′ 8.5″	5′ 7″	5′ 5″	5′ 3″	5′	4′ 8″	4′ 4″	3′ 10″
8″	11″	5′	F	5′ 1″	5′ 2″	5′ 3″	5′ 4″	5′ 6″	5′ 8″	6′	6′ 7″	7′ 6″	9′ 7″
			N	4′ 10.8″	4′ 10.3″	4′ 9.6″	4′ 8.6″	4′ 7.4″	4′ 6″	4′ 4″	4′	3′ 9″	3′ 4″
6″	8″	4′	F	4′ 0.8″	4′ 1.2″	4′ 1.7″	4′ 2.4″	4′ 3.5″	4′ 5″	4′ 7″	4′ 11″	5′ 5″	6′ 8″
			N	3′ 11.2″	3′ 10.9″	3′ 10.4″	3′ 9.8″	3′ 9″	3′ 7.8″	3′ 6″	3′ 4″	3′ 2″	2′ 11″
5″	7″	3′ 6″	F	3′ 6.6″	3′ 6.9″	3′ 7.3″	3′ 7.8″	3′ 8.6″	3′ 9.9″	4′	4′ 2″	4′ 9″	5′ 3″
			N	3′ 5.4″	3′ 5.1″	3′ 4.8″	3′ 4″	3′ 3.7″	3′ 3″	3′ 2″	3′	2′ 10′	2′ 7″
4′ 5″	6″	3′	F	3′ 0.5″	3′ 0.7″	3′ 0.9″	3′ 1.3″	3′ 1.9″	3′ 2.8″	3′ 4″	3′ 6″	4′ 2″	4′ 3″
			N	2′ 11.6″	2′ 11.3″	2′ 11.1″	2′ 10.7″	2′ 10.3″	2′ 9.6″	2′ 8.8″	2′ 7.5″	2′ 6″	2′ 4″
4′ 2″	5′ 5″	2′ 9″	F	2′ 9.4″	2′ 9.6″	2′ 9.8″	2′ 10.1″	2′ 10.6″	2′ 11.3″	3′ 0.3″	3′ 2″	3′ 4″	3′ 9″
			N	2′ 8.6″	2′ 8.5″	2′ 8.2″	2′ 7.9″	2′ 7.5″	2′ 7″	2′ 6.3″	2′ 5.2″	2′ 4″	2′ 2″
3′ 5″	5″	2′ 6″	F	2′ 6.3″	2′ 6.5″	2′ 6.6″	2′ 6.9″	2′ 7.3″	2′ 7.9″	2′ 8.7″	2′ 10″	3′	3′ 4″
			N	2′ 5.7″	2′ 5.6″	2′ 5.4″	2′ 5.1″	2′ 4.8″	2′ 4.3″	2′ 4″	2′ 3″	2′ 2″	2′
3″	4′ 5″	2′ 3″	F	2′ 3.3″	2′ 3.4″	2′ 3.5″	2′ 3.8″	2′ 4.1″	2′ 4.5″	2′ 5.2″	2′ 6″	2′ 8″	2′ 10″
			N	2′ 2.8″	2′ 2.6″	2′ 2.5″	2′ 2.3″	2′ 2″	2′ 1.6″	2′ 1″	2′	1′ 10.5″	1′ 10.2″
2″	4″	2′	F	2′ 0.2″	2′ 0.3″	2′ 0.4″	2′ 0.6″	2′ 0.8″	2′ 1.2″	2′ 1.7″	2′ 2.5″	2′ 3.6″	2′ 6″
			N	1′ 11.8″	1′ 11.7″	1′ 11.6″	1′ 11.4″	1′ 11.2″	1′ 10.9″	1′ 10.5″	1′ 9.9″	1′ 9.2″	1′ 8.1″
Hyperfocal Distance				238′	167′	119′	83′	59′ 6″	41′ 8″	30′ 4″	20′ 10″	15′ 2″	10′ 5″

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