OPERATION AND CARE OF

BELL & HOWELL

FILMO 70

MOTION PICTURE CAMERAS

KEEP THIS BOOKLET
IT CONTAINS VALUABLE INFORMATION

Foreword

The Bell & Howell Filmo 70 Cameras, the use of which is explained in this booklet, are recognized as the most flexible, most adaptable amateur motion picture cameras available at any price.

Bell & Howell Professional Cameras and equipment are used in the production of most of the world's photoplays. Filmo 70 Cameras are designed by the same engineers and built with the same exacting precision. This is why Filmo 70 results can rival those achieved by the professional cameramen.

With such a capable instrument in your possession, you will naturally want to produce films which reflect all of the potential powers of your camera. The shortest way to achieve such results is to study this instruction book carefully, with your camera before you, before starting to take pictures.

Important

Be sure to fill in and mail the registration card which accompanies this booklet. This will (1) bring you *Filmo Topics*, an interesting periodical on movie making matters, (2) give you the protection of the B&H guarantee, (3) entitle you to free annual camera cleaning and lubricating service for three years, (4) enable us to help find your equipment in case of loss or theft, and (5) assist our personal service department to cooperate with you intelligently.

OPERATION AND CARE OF FILMO 70 CAMERAS

Contents

Filmo 70 Camera Models

Abbreviations: UF, Universal Focus; Foc, Focusing Mount

Model No.	Lens	Speeds	Other Features
70-DA	1" F 2.7 Foc	8,12,16,24,32,48,64	3-Lens Turret, Variable Viewfinder, Critical Focuser
70-DB	1" F 2.7 UF	8,12,16,24,32,48,64	3-Lens Turret, Variable Viewfinder, 110° Shutter Rapid Only, Standard 204° Shutter for Athletic Form Analysis
70-E	1" F 2.7 Foc	8, 16, 24, 64	
70-G	1" F 1.5 Foc	128	

Loading the Filmo 70 Camera

Practice with the red and black paper leader supplied with your Filmo Camera until you become thoroughly familiar with the method of threading it. Then load with film.

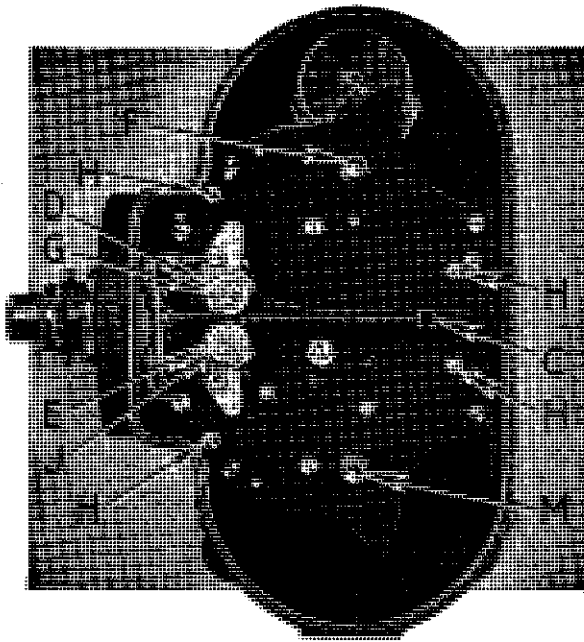

Figure 1

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

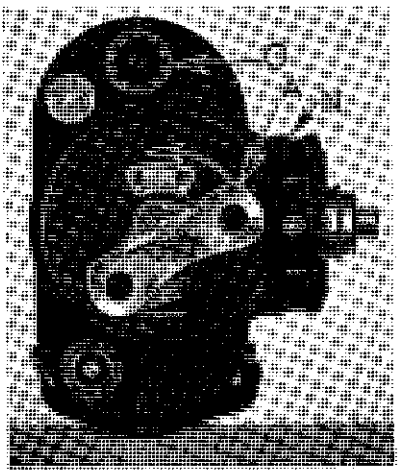

Figure 2

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

N. Starting button

O. Footage dial

NOTE: *While the Filmo Camera may be safely loaded and unloaded in daylight, always avoid direct sunlight*

1. 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).

2. 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.

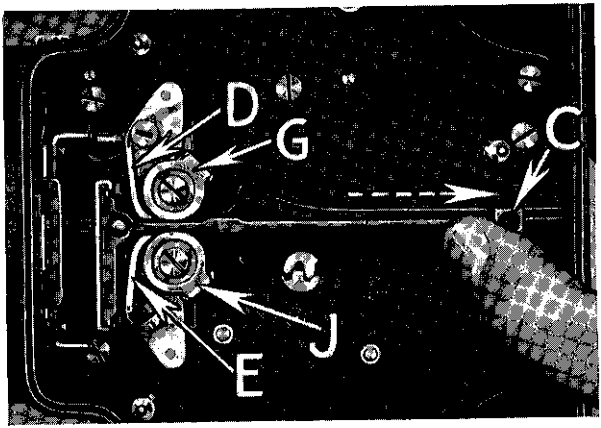

Figure 3

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

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

The camera must not be loaded and unloaded in direct sunlight. Find a shaded spot.

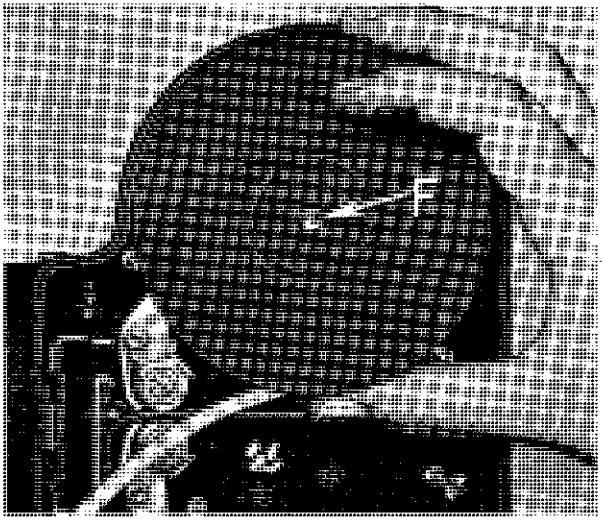

Figure 4

Inserting the feed spool over the feed spool spindle, F

4. Remove a spool of film from its metal container. Unreel about 18 inches of the leader or the film. *Paper leader is not used on many films today. 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.

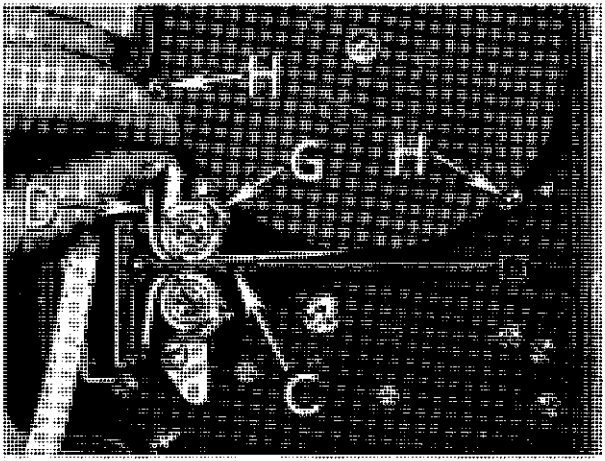

Figure 5

Threading film leader around the feed sprocket

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

With the square hole down and the leader feeding off the bottom of the spool to 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.

5. 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.

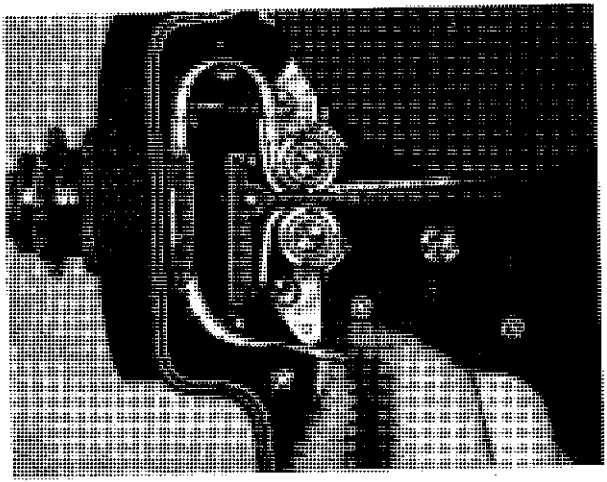

Figure 6

Inserting film leader in film gate channel

6. 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.

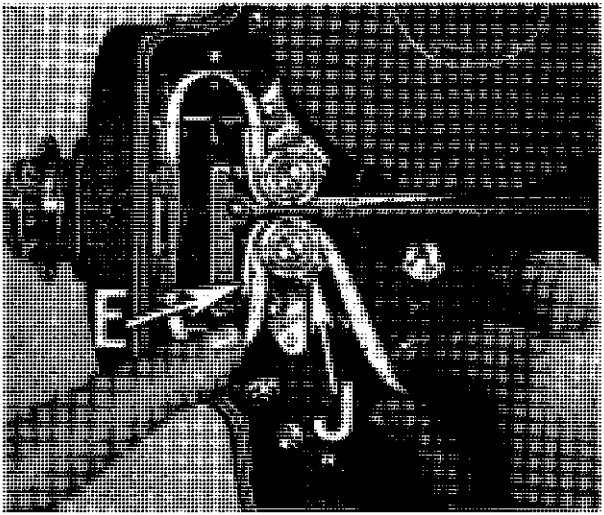

Figure 7

Threading film leader around the take-up sprocket

E. Lower film guide shoe J. Take-up sprocket

7. Leaving a lower loop of about the same size as the 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.

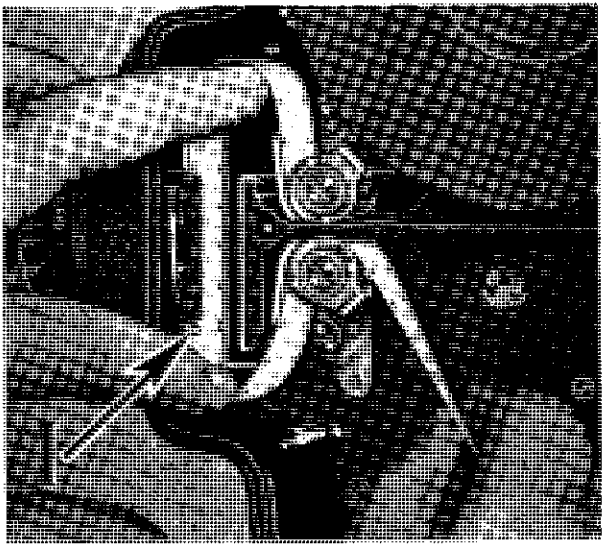

Figure 8

Engaging leader perforations with the two shuttle teeth, I

8. 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.

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

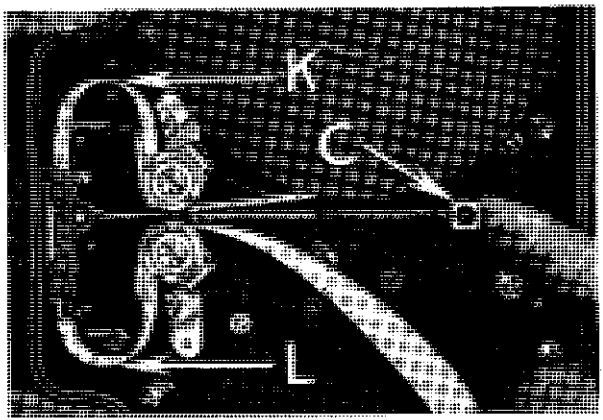

Figure 9

Closing the film gate with gate arm, C
K and L. Correct sized upper and lower loops, respectively

10. 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 in paragraph 8. 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 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.

11. Insert the end of the leader in the take-up spool hub slot, as shown in Figure 10. 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

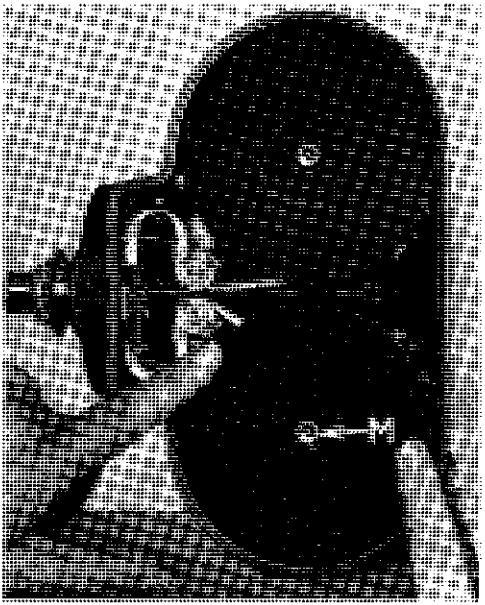

Figure 11
Inserting the take-up spool

12. Test the correctness of the loading and threading by pressing the 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.

13. 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.*

14. 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

15. 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 it to the nearest Film Developing Station (see address on card in film carton).

Special Precautions

16. Some Filmo 70 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.

17. An almost indispensable precaution is to test the take-up spool with the Filmo 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.

Taking Pictures

Be sure to remove the red rubber lens cap before taking pictures. Keep it on when not "shooting." It protects the lens from dust.

Winding the Motor

18. 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 Filmo 70 motor has a capacity of 23 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.

Speed Adjustment

19. Sixteen pictures or "frames" per second is the normal speed for taking and showing motion pictures and is the speed which should be used for most scenes.

70-DA Speed Adjustment Dial

20. The Filmo 70-DA 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.

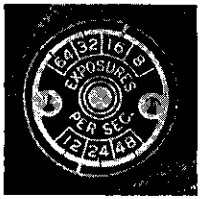

FIGURE 12

The Filmo 70-DA 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.

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 (1/14 and 1/21 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.

70-E Speed Adjustment Dial

21. The Filmo 70-E speed adjustment dial is shown in Figure 13. Any one of four film speeds—half (8), normal (16), sound (24), and super (64)—may be selected. Turn the outer knurled ring until its index mark coincides with the index mark in the segment indicating the desired speed. Intermediate speeds may also be used, as the change in the setting of the governor is gradual. Keep this dial set for normal speed, returning it to that position after taking scenes at other speeds. See paragraph 20 for the uses of the various speeds.

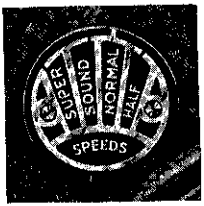

FIGURE 13

The Filmo 70-E speed adjustment dial, shown set for normal (16) speed operation

When using 8 speed, close the lens one stop more than for 16 speed; 24 speed—open the lens one-half stop more than for 16 speed; 64 speed—open the lens two stops more than for 16 speed.

Lens Setting

22. Pay particular attention to the lens. If your Filmo has the standard equipment, it has what is known as a 1-inch F 2.7 *universal focus* lens. 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 to about 15 feet when the lens is set to work at an aperture of F 2.7. The smaller the aperture, the less the shortest distance at which the subject will be in sharp focus. 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 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 term *F* 2.7 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 2.7, 4, 5.5, 8, 11, and 16. The dot on the pin at the center of the camera head is the index mark. Turn the number bearing ring until F 2.7 falls opposite this dot. 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 2.7, they are expanded to the maximum. When the light on the subject to be photographed is weak, F 2.7 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 16, 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 16 position, it is essential that, when pictures are to be made at this setting, the number 16 on the lens diaphragm ring be accurately lined up with the index mark.)

As you turn back from F 16 to F 2.7, remember that each stop gives twice the exposure (admits twice as much light) as the preceding stop. F 11 gives twice the exposure of F 16, F 8 gives twice the exposure of F 11, 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.

How to Hold the Camera

23. The position in which the camera is most advantageously held is shown in Figure 14. 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.

FIGURE 14
The correct way to hold the Filmo 70 Camera

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. (See Filmo Accessory Catalog.)

The 70-DA Turret Head

24. The Filmo 70-DA Camera may be purchased with from one to three lenses mounted upon its built-in turret head. If less than three lenses are purchased with the camera, the remaining openings in the camera head are closed with metal caps. These caps may be unscrewed and additional lenses screwed in at any time.

The 1" F 2.7 Cooke 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 under speed and light conditions which do not demand an opening greater than F 2.7. 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, as does a feeling of the revolving motion being automatically stopped at the correct spot and the registration of the index mark on the turret head with the word "Run" on the camera proper. (See Figure 17, page 27.) *The starting button is automatically locked until a lens is correctly seated*—a feature which saves film and disappointments.

24a. Lens Combinations. Any Taylor-Hobson lens listed below may be used upon the Filmo 70-DA 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.

Shortest lens on turret	Lenses which may be used on 70-DA turret with shorter focus lenses listed at left					
15 mm.	1"	2" TTH or Acura				
20 mm.	1"	2" TTH or Acura	3" TTH or Acura	*4" TTH or Acura		
1"		2" TTH or Acura	3" TTH or Acura	4" TTH *4" Acura	*6" F 5.5	
2"			3" TTH or Acura	4" TTH or Acura	6" F 5.5	6" F 4.5
3"				4" TTH or Acura	6" F 5.5	6" F 4.5

*Modifications necessary to avoid interference.

How to Use the Viewfinder

25. The area seen through the spy-glass 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 this 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 four feet or less from the camera, to make a corresponding allowance in the horizontal position of the camera to

compensate for this offsetting. At distances greater than four feet no allowance for the offset need be made.

The small opening on the right side of the viewfinder objective lens is for the purpose of observing the lens diaphragm stop number. This permits the operator to check his diaphragm adjustment just before starting to film a scene, and serves as a last minute reminder to adjust the lens for the prevailing light conditions and for the nature of the subject. The focusing scale of the new style 1" F2.7 focusing mount lens may also be seen through the viewfinder.

Filmo 70-DA Viewfinder

26. To set the Filmo 70-DA viewfinder, revolve the viewfinder dial (Figure 15) 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 vision through the viewfinder to exactly that of the photographic lens. The "20" means 20 mm.; others are inches.

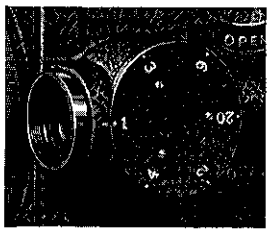

FIGURE 15
The Filmo 70-DA viewfinder, with the dial set for showing the field included by one-inch lens

Filmo 70-E Viewfinder

27. The Filmo 70-E viewfinder permits of no adjustment other than to replace the regular viewfinder eye-

piece and objective units with others which match lenses of focal lengths other than one inch, when such lenses are to be used.

The Starting Button

28. 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 17, Page 27) 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.

Supplementary Instructions For Filmo 70 Camera

29. An improved starting button lock has been incorporated in your Filmo 70-DA camera, replacing the gravity catch described in Paragraph 29 of the accompanying instruction book.

The Filmo 70-DA starting button (N) and run control. Starting button lock (B)

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.

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The Starting Button

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The 70-DA Gravity Catch

. The Filmo 70-DA Camera has a gravity catch hich holds the starting button down when the latter released slowly, thus keeping the camera in opera- n. This permits the operator to step into the picture.

The gravity catch may be used or not, at the choice the operator. Protruding at the edge of the turret ad, just below the starting button, is a portion of a urled disc (B, Figure 17, Page 27) which may be volved for a short distance up and down. To dis- nse with the functioning of the gravity catch, turn is disc upward. Then, whenever and however your ger pressure upon the starting button is released, the tton will rise and the camera mechanism will stop.

To cause the gravity catch to function in the usual way, turn the knurled disc downward.

To stop the camera after it has been kept operating by the functioning of the gravity catch, either press and *quickly* release the starting button, or turn the knurled disc upward, as directed above, to disengage the gravity catch.

The 70-DA Emergency Starter

30. On rare occasions a particle of foreign matter, getting into the camera head, may cause the mechanism to refuse to function when the starting button is pressed. Should this happen, see that the camera is wound, and then press firmly and repeatedly on the starting button until the camera starts. A new device, now built into all Filmo 70-DA Cameras, forces the mechanism to move slightly each time the button is pressed. Usually this will soon dislodge the obstructing matter. (Omitted from hand-crank models.)

70-DA Starting Button Lock

31. The starting button of the Filmo 70-DA Camera may be locked, if desired, to prevent accidental starting of the camera. This is done by revolving the turret so that any one of the three index marks on the edge of the turret head falls opposite the word "Lock" (Figure 17, Page 27) 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."

70-DA Relative Exposure Indicator

32. The celluloid Exposure Calculator supplied with

your camera gives the diaphragm settings to use under various lighting conditions and for various types of subjects, and is correct for pictures taken at normal (16) speed. Each of the other six speeds at which Filmo 70-DA may be operated requires an exposure modification to compensate for the increase or decrease in shutter speed. For this reason a relative exposure indicator is built into the Filmo 70-DA Camera. This indicator is located low down on the right side, and is shown in Figure 16.

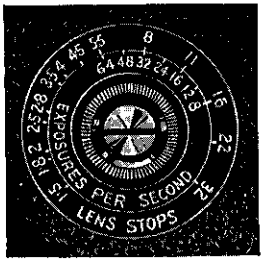


FIGURE 16

The Filmo 70-DA relative exposure indicator, shown set for a normal speed exposure of F 11. Exposures for all other speeds are read directly

As an illustration of how the relative exposure indicator is used, let us assume that the exposure calculator specifies F 11 as the correct normal speed diaphragm setting for a particular scene. We turn the inner dial until the figure 16 (normal speed) index mark coincides with the F 11 index mark on the outer dial. The correct lens stop setting for any speed may now be read directly on the outer dial, opposite the index marks of the various speeds on the inner dial.

If 64 is the speed to be used on the scene in question, we look at the 64 speed index mark and find that it now falls opposite the F 5.5 index mark. Therefore F 5.5 is the correct setting at 64 speed for a scene which would require F 11 at 16 speed.

33. Revolve the turret head to bring the lens to be focused into the position of the lens T, in Figure 17, where it is held fast and in proper alignment by a safety catch, which gives the feeling of the revolving motion of the turret being stopped. Then point the camera to the object you desire to photograph and sight through the eyepiece (S, Figure 17). If you hold the camera right side 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 to see a non-inverted image, hold camera on its side.

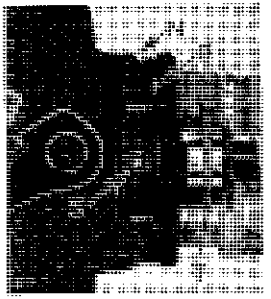


FIGURE 17

The Filmo 70-DA starting button (N) and lock and run control. Critical Focuser Eyepiece (S) also shown, with lens (T) in position for focusing. B—Gravity catch release

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. First focus the eye so that the grain of the ground glass is sharp. 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 possi-

bility 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 Filmo 70-DA Camera design is this—when the lens is in 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.

Colored Movies

34. With all Filmo cameras, Kodachrome full-color movies are as easy to make as monochrome, or black-and-white, pictures. There are, however, three important precautions to observe:

1. For correct exposure, Kodachrome film requires more light than black-and-white film. All of the lenses supplied by the Bell & Howell Company for use on Filmo cameras are fully corrected

for color and may therefore be used with Kodachrome film, but the lens diaphragm must be opened to admit approximately twice as much light. For instance, if F 8 is the normal exposure for regular black-and-white panchromatic film, for Kodachrome film the lens scale should be set to F 5.6 when the scene contains few shadows, or a position midway between F 5.6 and F 4 if more than half of the scene is in shadow. (Read carefully the instructions supplied in film package.)

In other words, if you are accustomed to judging light for black-and-white film, open the lens one division (photographers call it one "stop"), depending upon the composition of the scene, as outlined above.

2. Kodachrome film has a necessarily limited exposure latitude, and a slightly incorrect setting of the lens will result in proportionately incorrect color values. The diaphragm of each lens must therefore be set with much greater accuracy than is required for black-and-white film. A reliable and sensitive exposure meter will soon pay for itself, as a result of the savings effected through elimination of wasted film.

3. A special film is available known as Kodachrome "A" to photograph indoor scenes in natural color. Use this special film for all natural color movies made under artificial lights.

If careful attention is given to these three points, surprisingly realistic full-color movies can be made.

Kodachrome film is processed and returned, ready for projection, in the same way that black-and-white film is handled. Follow the same instructions for threading and operating the camera. Further information concerning the use of this film is supplied with each carton, and the Technical Service Department of the Bell & Howell Company will be glad to answer in detail any questions which you may have concerning natural color movies.

Filmo 70-DB Camera

35. Filmo 70-DB differs from Filmo 70-DA in having a shutter opening of 110 degrees rather than 204 degrees. This means that the exposure time is only half as long as on regular models—about 1/52 second rather than 1/28 second. Consequently the 70-DB lens diaphragm should always be opened up to one stop larger than that specified by the exposure chart or meter.

Length of Scenes

36. 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 cam-

era 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.

What to "Shoot"

37. Plan your shots to take full advantage of the possibilities of motion pictures. Probably your first pictures will be of family and friends. Avoid posed pictures—leave these for the still camera. You will very likely get your best scenes when your subjects are not conscious of being filmed, or when you can get them so interested in and occupied with their action that they forget the camera.

Plan your shots wherever possible to tell a little story of some kind, whether it be a simple account of a day's events at home or a chronological record of a holiday trip. Scenes need not necessarily be exposed in the order in which you want them to appear when projected, as they can be cut and spliced, after being developed, into any sequence

Panoramic Pictures

38. Panoramic views (made by pivoting the camera in a horizontal plane while it is in operation) often provide very pleasing additions to moving picture films. But if panoramas are not properly made they are anything but satisfactory. There are several precautions to be observed if "pams" are to be successful.

First, pivot slowly on every pam! When you think you are going slowly enough, cut your pivoting speed in half and you'll be better satisfied with the results.

Second, pam evenly and steadily. A jerky pam is hard on the eyes when projected, and, furthermore, causes disappointment at not being able to see the subjects clearly for a sufficient length of time.

Third, do not attempt to panoram when a still shot will tell the story or get the desired scene. An abundance of pams makes a film tiresome, so save them for the proper occasion.

Often the following method will improve your pams. Swing slowly past objects of general interest until your viewfinder frames a picture of especial appeal. Hold the camera steadily on that scene for about 10 seconds (4 feet), then swing slowly on to the next scene of importance and stop again. This handling of the problem will give your audience ample time to enjoy each outstanding point of the scene and still retain that value of the pam—the showing of elements in their relation to each other.

Filming Moving Objects

39. In panoraming to follow moving objects the problem becomes different. Here the camera should be swung to keep the subject constantly as nearly as possible in the center of the field of view. The background, which may be blurred in the process, is *not* the most important element. Such pams should be arranged so that the object is not moving directly across in front of the camera (at a right angle). Have the subject moving toward or away from the camera

at an oblique angle. In this way a minimum of panning will get all the action. If the action must take place at right angles to the camera, do not attempt a short shot, but get at least thirty feet away from the line of action before starting the camera.

Lighting

40. Not only is light essential in photographic work, but it is a tool which permits artistic molding of the picture. Depending upon how the lighting is handled, the subject may be portrayed in almost stereoscopic depth and relief, or, at the other extreme, in a flat, unnatural manner. Since the subject of light is so important and so rich in its possibilities, it is recommended that the amateur read the chapters on this subject in one or more books on cinematography.

The F 2.7 lens with which Filmo 70 Cameras are equipped is about four times as "fast" as the usual inexpensive still camera lens. This means that you can get properly exposed pictures outdoors earlier or later in the day, and that you do not need bright sunlight.

Close-ups (motion picture portraits) are usually better if taken in a subdued light as they are free from the dark shadows found in similar scenes taken in bright sunlight. A shady spot, open to the sky, is a good location for making close-ups.

Full front lighting (sun directly behind the camera) tends to give a flat picture, lacking in depth. Side lighting is better as a general rule, and oblique lighting is to be preferred to full front lighting.

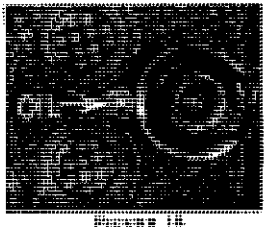
Pictures taken with the sun directly overhead (at or near noon) usually lack in pictorial quality as compared with those taken when the shadows are longer.

Cultivate the habit of studying the effect of light upon various subjects. You will find that while a subject may be quite lacking in pictorial possibilities in one light, it may offer a wonderful effect when the sun strikes it from a different angle.

Care of Filmo 70 Cameras

Lubrication of Filmo 70-DA and 70-E

41. Filmo 70-DA and 70-E Cameras require adequate lubrication. Five oil holes are provided, one at the center of the head (Figure 18) and four in the plate beneath the film spools (Figure 19). To get at the oil hole on the camera head, pry out the capped pin which plugs this hole, using a pen knife or a small screw driver. Each of the five holes should receive one or two drops of Filmo 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.)



Withdraw capped pin and oil as directed in paragraph 41

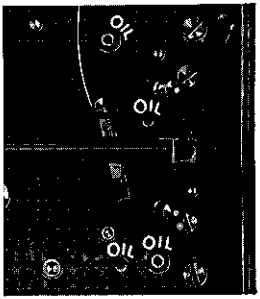


FIGURE 19
Put oil in these four holes as directed in paragraph 41

Lubrication of Filmo 70-A

42. Two places on the Filmo 70-A Camera should be oiled about once a month or after every five or six rolls of film used. Remove with a penknife the *two* caps on the camera head, putting in one or two drops of Filmo Camera Oil. Replace the caps securely. No other lubrication is necessary.

Free Oiling and Cleaning for Three Years

43. All Filmo Cameras and Projectors are liberally guaranteed. See guarantee form for details. The Filmo guarantee provides that this equipment will be thoroughly cleaned and lubricated once a year for three years, without charge. After three years this desirable service will be rendered at a nominal charge. It is urged that every Filmo owner take advantage of this service annually to insure getting the best results and longest life from his equipment.

Cleaning Lenses and Viewfinders

44. 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 the B & H Lens Cleaning Kit, which may be had at a nominal cost, or B & H Lens Cleaning Tissue. Color filters should receive the same attention as lenses.

After cleaning the lenses, make sure that each lens is screwed firmly into the camera.

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

Cleaning Aperture Plate and Film Gate

45. The aperture plate and the back plate (Q and R respectively, Figure 20) 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. Never use a penknife or other metal tools, as you may mar the surface. Wipe with a clean, dry, linen handkerchief. If emulsion accumulations remain, remove them with a moistened toothpick. Clean the upper and lower film guides (D and E, Figure 20) in the same way.

FIGURE 20

Filmo 70 interior parts requiring cleaning as directed in paragraph 45. Q—aperture plate, R—back plate, D and E—upper and lower film guide shoes

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

Adjusting the Lens Diaphragm Stop Dial

46. When placing a new, or replacing a formerly used, Cooke 1″ F 2.7 universal focus lens in the Filmo 70 Camera, it may be found that the diaphragm stop dial does not give correct readings. This dial, bearing one set of figures which may be seen through the viewfinder and another set which registers with an index mark at the center of the camera head, is clamped to the diaphragm ring proper on the lens by four small screws.

With the lens firmly screwed into the camera head, compare (at F 16) the diaphragm stop dial reading with that of the diaphragm index on the lens barrel, near the diaphragm adjusting ring. If the two readings are not identical, loosen the four small screws (seen in Figure 21). Do not make more than one turn, or the screws will fall out.

The dial will now move freely on the diaphragm ring of the lens. Adjust the dial so that the figures will read correctly, comparing with the engraved "16" on the side of the lens barrel, and tighten the four screws to hold the dial in that position. When the dial is set correctly, it will register F 2.7 with the lens wide open, and F 16 when the lens is closed down. This setting should be checked occasionally.

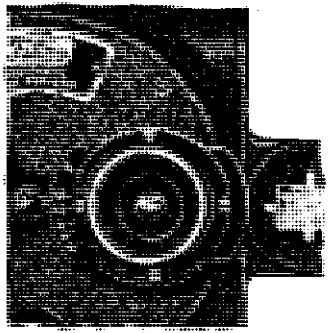


FIGURE 21
Showing the four screws which clamp diaphragm stop dial to the diaphragm ring on the lens

See form No. 15,127 for corresponding adjustment of the Cooke 1″ F 2.7 *focusing mount* lens.

Using the 70-G Superspeed Camera

47. The Filmo 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 Filmo 70 Cameras *with the following important exceptions:*

Threading

48. 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 Filmo 70 Cameras.

Operation

49. 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

50. 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

51. Clean the aperture plate and film gate after every roll of film, following the procedure outlined in paragraph 45. Also follow the lubrication instructions for Filmo 70-DA as given in paragraph 41, but oil the camera after every 200 feet of film have been exposed, instead of after every five or six hundred feet.

Hand-crank on Filmo 70 Camera

52. A supplementary instruction sheet explaining the use of the hand crank with Filmo Cameras is available on request.

Centrally Located Service Stations

When your Filmo equipment is in need of repairs, send it to the nearest Bell & Howell service station (addresses on back cover) and have the assurance that the work will be done properly by factory-trained experts. Your dealer will be glad to take care of packing and shipping.

PICTURE AREAS (Approx.) covered by Filmo Camera Lenses

Note: For camera distances from 1 to 9 feet, read the following table direct. For greater distances, simply move decimal point. Example: Area width for 1-inch lens on a 16 mm. camera is 2.26 feet at a distance of six feet. At sixty feet it would be 22.6 feet; at six hundred feet it would be 226 feet.

Lens Focal Length	Plane	Angle	Distance from Camera in Feet								
			1	2	3	4	5	6	7	8	9
15 mm.	Horizontal	36°- 6′	.64	1.27	1.91	2.55	3.18	3.82	4.46	5.10	5.73
	Vertical	27°- 6′	.47	.95	1.42	1.90	2.37	2.85	3.32	3.80	4.27
1″	Horizontal	21°-22′	.38	.75	1.13	1.51	1.88	2.26	2.64	3.01	3.39
	Vertical	16°- 9′	.28	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52
2″	Horizontal	11°- 4′	.19	.38	.56	.75	.94	1.13	1.32	1.50	1.69
	Vertical	8°-14′	.14	.28	.42	.56	.70	.84	.98	1.12	1.26
3″	Horizontal	7°-20′	.13	.25	.38	.50	.63	.75	.88	1.00	1.13
	Vertical	5°-26′	.09	.19	.28	.37	.47	.56	.65	.75	.84
4″	Horizontal	5°-30′	.09	.19	.28	.38	.47	.56	.66	.75	.85
	Vertical	4°- 5′	.07	.14	.21	.28	.35	.42	.49	.56	.63
6″	Horizontal	3°-40′	.06	.13	.19	.25	.31	.38	.44	.50	.56
	Vertical	2°-43′	.05	.09	.14	.19	.23	.28	.33	.37	.42

HYPERFOCAL DISTANCE for Filmo Camera Lenses

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. All objects at the hyperfocal distance and beyond will be in focus. The table below shows the hyperfocal distances for lenses for Filmo 16 mm. and 8 mm. Cameras, expressed in feet and based upon a circle of confusion of .001-inch diameter, which makes the table suitable for very critical work. For average work with 16 mm. film, a .002-inch circle of confusion can be used. This would halve every hyperfocal distance.

Lens Focal Lengths	F Values															
	F1.4	F1.5	F1.8	F2.0	F 2.5	F 2.7	F 3.5	F 4.0	F 4.5	F 5.0	F 5.6	F 6.3	F 8	F 11	F 16	F 22	F 32
12½mm.	14½	13½	11¼	10	8	7½	5¾	5	4½	4	3½	3¼	2½	1¾			
15 mm.					11½	10½	8	7	6½	5½	5	4½	3½	2½	1¾		
20 mm.					26¼	24¼	19	16½	14¾	13¼	9½	8½	6½	6	4		
1-inch	59½	55½	46¼	41¾	33½	30¾	23¾	20¾	18½	16¾	14¾	13½	10¾	7½	5½	3¾	
1½-inch					75	69½	53½	46¾	41¼	37½	33½	29¾	23½	17	11¾	8½	
2-inch		222	185	167	133	123	95	83	74	67	60	53	42	30	21	15	11
3-inch					300	278	214	187	167	150	134	119	94	68	47	34	23
4-inch					533	494	381	333	296	267	238	212	167	121	83	60½	42
6-inch					1200	1100	857	750	667	600	536	476	375	273	188	136	94

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