# INSTRUCTIONS

FOR USING
THE

# WESTON

UNIVERSAL
## EXPOSURE METER

MODEL 617

FOR
STILL *and* MOTION
PICTURE CAMERAS

WESTON ELECTRICAL
INSTRUMENT CORPORATION
NEWARK, N. J.

## *CAUTION*

When aiming the Exposure Meter at the scene being photographed, to measure its brightness care should be exercised not to allow the fingers to drop behind the meter in such a manner as to partially cut off the light from reaching the photoelectric cells in the back of the meter, as this would cause an erroneous reading.

# DESCRIPTION OF METER

The Weston Exposure Meter consists essentially of two parts; a meter for measuring the brightness of the scene to be photographed and a mechanical calculator for translating the light values measured into the proper apertures and shutter speeds to give correct exposure.

**The Meter.** The meter consists of a sensitive electrical instrument connected to two Weston PHOTRONIC Photoelectric Cells or electric eyes located at the bottoms of tubular depressions at the back of the meter. The depressions are partitioned to limit the extent of the scene covered to a cone with an angle of 60° at the meter.

The cells are the direct action type, require no batteries and have an unlimited life. They transform light energy directly into electrical energy.

The instrument has two ranges. When the button on the top is free, the scale reads from 0 to 1300 candles per sq. ft. When the button is depressed, each number must be divided by 10 (simply omit the last zero) and the scale becomes 0 to 130 candles per sq. ft.

**Mechanical Calculator.** The calculator as shown in Figs. 1, 3, 4 and 5 consists of three dials. The fixed black dial contains light values corresponding to figures on the instrument scale and values for various plate or film speeds.

The red dial contains shutter speeds. It is movable, but has to be reset only when changing the kind of film from say amateur film to panchromatic or when using artificial illumination. The dial is locked in position by a pin and can be moved only by lifting the dial while turning so that the pin clears the hole. This prevents an accidental change in position without knowledge of the user.

The blue dial is the exposure dial and is the only one requiring setting for each exposure. Only one setting is required. This dial contains scene locations and stop numbers.

The dial markings are so designed that all values affecting exposure are approximately doubled at every second division as will be seen in the illustrations, remembering that exposure is proportional to light value, to shutter time and inversely as the square of the stop number. For example, a light value of 50 and a shutter speed of 1/25 second each gives double the exposure given by 25 and 1/50, respectively, but a stop of f/8 gives twice the exposure given by stop f/11.


**THE WESTON UNIVERSAL EXPOSURE METER—MODEL 617**

# Instructions for Using
# THE UNIVERSAL EXPOSURE METER

The Weston Exposure Meter is a device for quickly determining the correct exposure of photographic film and plates under various conditions of light and scene. This device is exceedingly simple to use as will be seen by the following instructions.

Diagrams are shown in color so that operations can be visualized at a glance.

## SET MECHANICAL CALCULATOR FOR SPEED OF FILM BEING USED

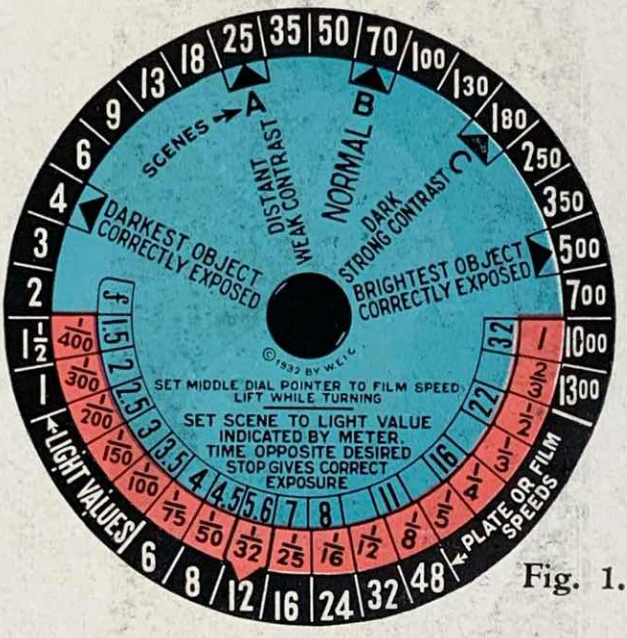


Fig. 1.

Set red dial arrow to film speed on black dial.

To turn red dial, slightly lift it with thumb nail under the arrow point and index finger at center of Calculator, then turn to desired film speed.

This setting remains unchanged until a film of different speed is used.

Table of film speeds shown on page 11.

## DETERMINE CHARACTER OF SCENE WHETHER A, B OR C

A—**Distant Scenes**—These include clouds, views of the open sea, distant landscapes—these usually have high light values.

B—**Normal**—These includes all ordinary scenes not included in A or C, such as open streets, ordinary landscapes, portraits in the sun or shade, beach and river scenes, scenes of objects, including portraits on ship's decks, etc.

C—**Dark or Strong Contrast**—These include narrow streets or streets among high buildings, ravines and scenes under trees with heavy foliage. That is, all scenes which are relatively dark even at midday and ordinary scenes having very dark objects in which detail is desired.

## ASSUME THE SCENE IS B—NORMAL— THEN USE METER AS FOLLOWS:

Aim the Meter by sighting thru the notch toward center of scene. Read the light value indicated on the instrument scale. Let us assume the reading is 180.

If the reading is below 130, then press the button on the top of the meter to get a greater deflection and divide the reading by 10, by omitting the last zero.

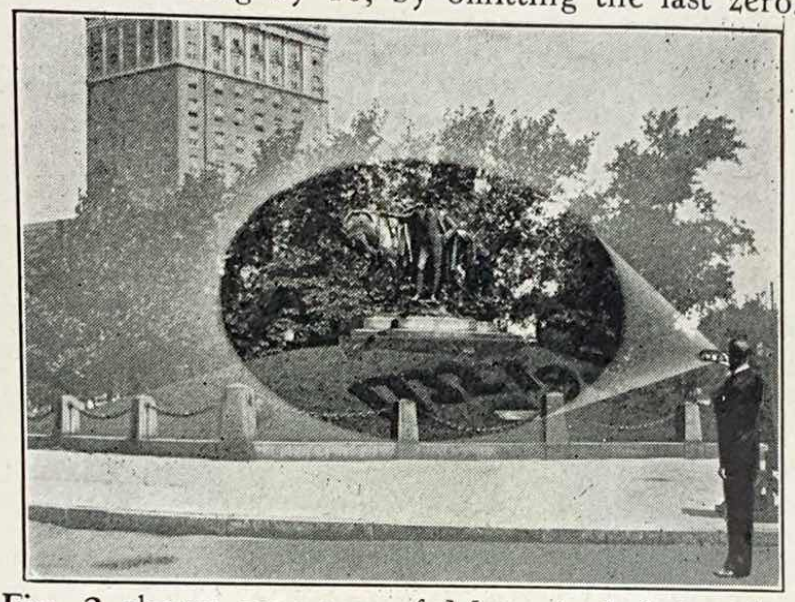

**Fig. 2** shows coverage of Meter included within a cone of light having a 60° angle. Tilt this imaginary cone of light to eliminate as much sky as possible.

## NOW OBTAIN CORRECT EXPOSURE

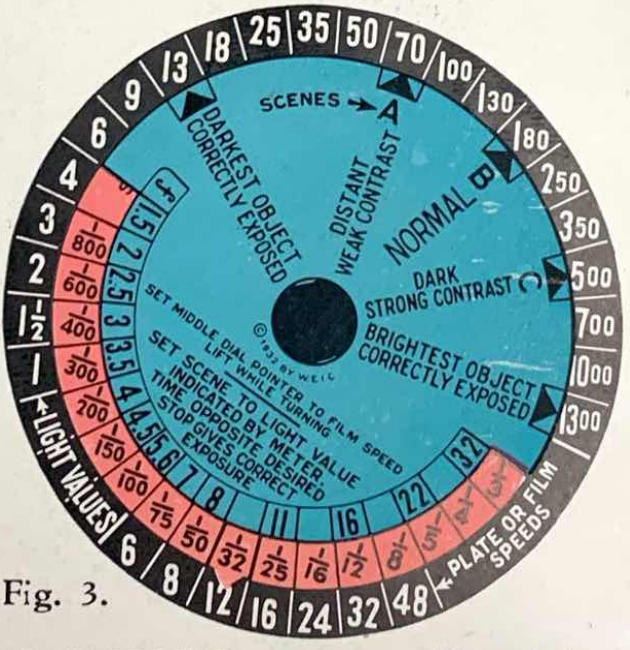


Fig. 3.

Turn B NORMAL arrow on blue dial to the assumed reading of 180 on black dial. The calculator is now set to indicate proper combinations of shutter timing and aperture for correct exposure. Select the desired shutter timing on red dial and the proper aperture to be used appears opposite on the blue dial.

Now set the camera to correspond with these values.

# ADDITIONAL EXPOSURE METHODS

Where doubt exists whether the scene is A, B or C the "darkest object" method will be found convenient if the darkest object can be approached closely with the meter. When the average brightness is too low to be measured accurately such as in interiors, very dark ravines, etc., then the "brightest object" method will be found desirable.

## "Darkest Object" Method

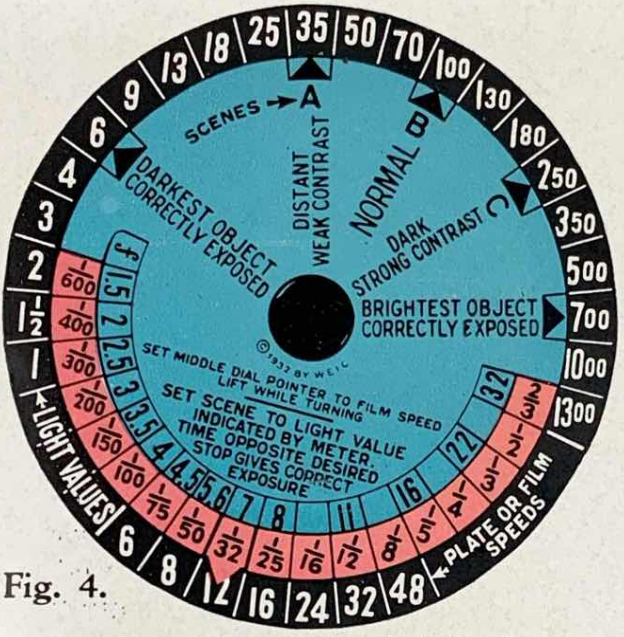


Fig. 4.

The red dial arrow is set to film speed.

Measure the light from darkest object in the scene by coming close to it as described on pages 4 and 7.

Set the "darkest object" arrow on the blue dial to the light value just measured on the black dial.

Read on blue and red dials the proper shutter timings and apertures as described on page 4.

## "Brightest Object" Method

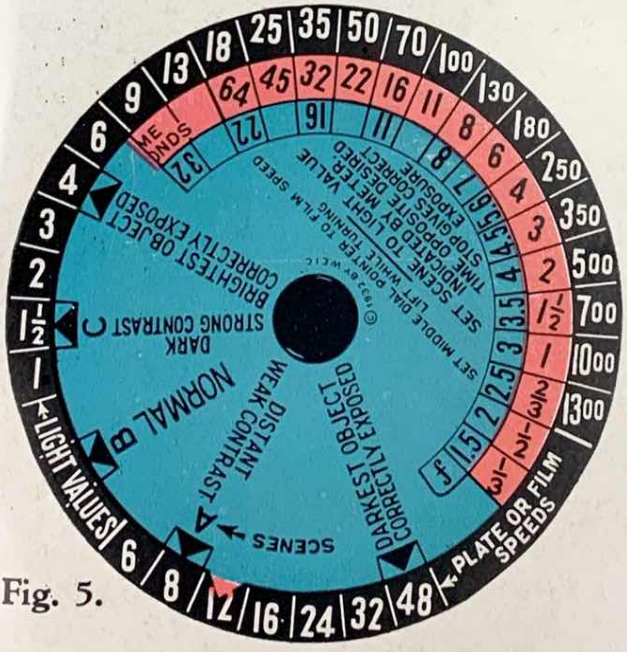


Fig. 5.

The red dial arrow is set to film speed.

Measure the light from brightest object in the scene by coming close to it as described on pages 4 and 10.

Set the "brightest object" arrow on the blue dial to the light value just measured on the black dial.

Read on blue and red dials the proper shutter timings and apertures as described on page 4.

# DETAILED INSTRUCTIONS

The principle of operation of this Exposure Meter is based upon the rule long known to photographers, namely, "Expose for the shadows and the high lights will take care of themselves." In addition, however, the meter is provided with means for also determining the effect of the high lights as well.

Any scene consists of objects varying in brightness from the darkest to the lightest and usually with all light tones between. It is this variation in light and color values which gives character to the subject. In some scenes the darkest object may be brighter than the brightest object in others, as for example beach scenes and in ravines. Now all of these gradations in brightness and color are faithfully reproduced in the luminous image upon the photographic plate or film by the lens, and in corresponding positions. To obtain a perfect negative it is necessary that each light tone shall act upon the sensitive material at the place where its luminous image occurs, and in proportion to its brightness. It is quite obvious that if sufficient exposure is given so that the light entering to form the image of the darkest object properly acts upon the sensitive material, then there will be at least light for all brighter objects.

Photographic films are of course limited in the range of light values which they can faithfully reproduce. As a general average among commercial films, the ratio of the brightest to the darkest object which they will correctly reproduce is about 128 to 1. If the ratio in any scene is greater than this, then either the darkest will tend to under exposure or the brightest to overexposure. It is fortunate that in most scenes which are desirable to photograph, the variations in brightness are less than this value. The blue dial gives this film range, which lies in the light range between the positions marked "Darkest Object" and "Brightest Object Correctly Exposed."

The following are the various methods for using the PHOTRONIC Exposure Meter for determining correct exposure.

**Plate Speeds.** First set red dial, once for all, to the speed of the plate or film being used, by placing the index finger at the center of the calculator and with the thumb nail under the red arrow point lift the dial and turn to the number

on the black dial corresponding to its plate speed. This dial need not be changed unless a change is made to another kind of film or to artificial illumination. Plate speeds are given on page 11.

(1) **Darkest Object Method.** If the deepest shadow or darkest objects in any scene to be photographed, in which detail is desired to be shown, can be approached sufficiently close to make a direct measurement, then direct the meter toward that object, using the notch at the top of the case for sighting. It is necessary to get close enough to the object so that no light from any other source reaches the sensitive plates of the meter. A good rule is to hold the meter so that its distance to the object is no greater than the least dimension of the object. Care must always be taken to stand in such a position that the body of the photographer does not interfere with the natural illumination of the object being measured. The meter may be placed at any angle to the object without detriment. A simple method for determining the correct location of the instrument is to move it back and forth slightly, and if the meter is properly located this displacement will not appreciably change its indication. Then note the light value number on the scale indicated by the pointer. If the indication is at the lower part of the scale, as is likely to be the case in this method, then press the button to increase the deflection and divide the reading by 10, by simply omitting the last zero.

Let us assume this indication to be say 6 (Fig. 4) the brightness of the darkest object. To translate this into exposure values, set the blue dial so that the arrow marked "Darkest Object" points to 6 on the "black dial." It is assumed that the red dial arrow has already been set to the speed of the film being used, say ordinary amateur, that is to 12, as given in Table of Film Speeds, page 11. Then any stop used with the shutter speed (time) directly opposite it on the red dial will give correct exposure. For example, if a shutter speed of 1/25 sec. is desired, then correct exposure will be obtained by using stop f/8 as indicated on the f scale. The blue dial also shows when this stop and shutter speed are used, that all objects in the scene, if any, having light values up to 700, which is shown by the arrow marked "Brightest Object," will be correctly exposed, as this represents the range of the film for correct exposure. If the scene is comparatively dark, that is without brilliant high lights, then the ex-

posure may be increased, with safety, to obtain greater average density on the negative. It is only necessary to be sure that the brightest object in the scene does not exceed the value indicated on the blue dial. For example, if it has been found by measurement that the brightest object does not exceed 180, then the exposure may safely be doubled, that is stop f/5.6 may be used.

It often occurs that the brightest objects in a scene are of such a nature that correct rendering is not important or desirable, as for example, direct reflections of the sun on polished objects, or from windows or water. It is often desirable that such lights be allowed to extend into the over-exposed region of the film, that is, beyond the positions marked "Brightest Object" as they will be softened in the negatives.

(2) **Average Brightness Method.** Where it is inconvenient or impossible to measure the light value of the darkest object directly, then the average values of the entire scene must be measured by directing the meter toward the center of the scene, using the notch at the top of the case for sighting. In this measurement it is preferable to have as little sky included as possible. For example, if buildings with reasonable foreground are to be photographed with open sky overhead, then the meter should be directed slightly downward so that the imaginary 60° cone area covered by the sensitive plates does not extend into the sky area.

Before the exposure can be finally determined when using the average method, it is necessary to decide upon the character of the scene. The calculator divides all scenes into three general classes as follows:

**"A—Distant, Weak Contrast."** These scenes are usually very bright, and do not have a great variation in brightness. Among these are included clouds, direct views of open sea, some snow scenes with few dark objects, and distant landscapes.

**"B—Normal."** These comprise the ordinary scenes, such as well lighted streets, ordinary landscapes, portraits in the sun or shade, river and beach scenes, and scenes of objects, including portraits on ship's decks. In fact it is often simpler to decide that the scene is "Normal" if it does not belong to Scenes A or C, which are easily recognized.

**"C—Dark or Strong Contrast."** This designation comprises scenes where the general level of light values is low, that is, of order of 70 and less at midday, such as is found in narrow streets,

or streets among high buildings; in ravines and under trees with heavy foliage. It also includes subjects containing both very dark and very bright objects, where it is desired to obtain details in the dark objects even at the expense of overexposure in the brightest ones. An example of this subject is a street scene which consists mostly of important dark buildings built of, say dark granite or brick, and a few very light colored buildings in the sun. The former may have an average brightness of less than 70, while the latter may exceed 300 candles per sq. ft. as indicated by the meter. In this case the brightness range in the subject may exceed that of the film and in order to correctly reproduce the desired details in the darker objects forming the important parts of the scene it is necessary to allow the few extreme high lights to extend into the region of overexposure, as indicated by the arrow on the blue dial at the "Brightest Object" position.

**Determination of Exposure.** Let us assume that the scene we wish to photograph is Normal, say a street scene with relatively well lighted buildings, and figures. Direct the meter toward the subject at about the center as it will appear on the film and measure the average brightness. Assume that button is free and the instrument pointer indicates 180 (Fig. 3).

Then set the "B—Normal" arrow on the blue dial of the calculator to the light value 180 on the black dial. Then the correct exposure in the camera will be obtained for any of the stop numbers when used with corresponding shutter speeds. Assume a convenient shutter speed to be 1/25 sec., then the correct stop will be f/11 found on the blue dial at the position corresponding to 1/25 on the red dial.

Frequently the stop corresponding to the desired shutter speed lies on a blank space between two numbers, for example between 8 and 11. The diaphragm index on the camera should likewise be set between the two corresponding numbers.

When directing the exposure meter toward any subject, especially those nearby, as for individual or group portraits, care must be taken not to include high lights beyond and forming no real part of the subject to be photographed. In such cases it is preferable to make the measurements of light values by coming very close to the subject.

**A—Distant Scenes**—The same procedure for distant scenes should be followed as for Normal Scenes just described. Such scenes include clouds;

distant landscapes; direct views of open sea. They are usually of a high average brightness and the light has usually high actinic values, that is, it contains the colors to which plates or films are especially sensitive. It is for this reason that it is preferable to favor the low side rather than the high side of measured exposure values. The arrow on the blue dial designated "A—Distant Scenes" should be set to the number on the black dial corresponding to the measured light value and the exposure determined as described above.

**C—Dark Scenes**—In a manner similar to the description given above for "Normal" Scenes, the average value of the scene is measured and the "C—Dark Scene" arrow on the blue dial is set to the number on the black dial corresponding to the measured light value and the exposure determined as described. These scenes are usually of low average brightness of the order of 70 or less even at midday.

For very dark scenes and interiors the following method of measurement will be found to give excellent results.

**Brightest Object Method.** For very dark subjects such as interior views, or very dark ravines, etc., where the average brightness is too low on the instrument scale to be measured with any reasonable degree of accuracy, it is preferable to measure the brightest object in the subject in which detail is desired, by coming close to it, and then set the arrow "Brightest Object" to this measured light value (Fig. 5). Do not use as the brightest object a window looking outdoors in an interior, or a sun spot in a ravine, or a similar accidental high light. Use objects really belonging to the scene desired to be reproduced. This is the same principle of exposure measurement as described above for "Darkest Object Method" except that the exposure for the brightest object is given a value to place it at the high end of the film range, instead of the low end, and all objects of lower brightness in the subject down to the lower limit of the film range will be correctly exposed. For example, if the brightest object in a given scene, say part of the wall of an interior view, has a light value of 4 candles per sq. ft., then the "Brightest Object" arrow on the blue dial is set to 4 and if stop f/16 is used and as indicated by the calculator, a time of 32 seconds is given, all objects having a brightness down to 4/128 or 1/32 candle per sq. ft., if any, will be correctly exposed, since the calculator range from brightest to darkest object is approximately 128 to 1.

**Motion Picture Cameras.** The Weston Exposure Meter is entirely universal in its application, and the same procedure should be followed for motion picture cameras as described above, except that the shutter frequently has only one speed, or at most two or three speeds.

The usual speed is 1/32nd second, and for convenience this speed on the red dial of the calculator is marked by an arrow index which serves also to indicate plate speeds.

**Artificial Illumination.** When photographs are made under artificial illumination the plate or film speeds are in general reduced below that for daylight.

Table I gives the plate or film speed numbers to be used on the calculator for both daylight and for tungsten light source of illumination.

**TABLE I**

**Plate Speeds**

| Plate or Film | Daylight | Tungsten |
|---|---|---|
| Ordinary Amateur | 12 | 6 |
| Verichrome or Plenachrome | 16 | 8 |
| Regular Panchromatic | 16 | 12 |
| Super Panchromatic | 24 | 16 |

**Light Values.** In Table II will be found average values of brightness found in nature and in the usual subjects met with in photographic work. Except where otherwise specified, the values given refer to clear days between 9 A.M. and 3 P.M. They will vary greatly for other conditions and are given merely as a rough guide.

**TABLE II**

| Subject | Brightness, Candle Sq. Ft. |
|---|---|
| Clear Blue Sky, opposite Sun | 350 |
| Clear Blue Sky, at Sunset | 16 |
| Blue Sky, White Clouds | 400–800 |
| Hazy Sky, Sun just hidden | 1000 |
| Green Foliage and Grass in Sun | 50–160 |
| Light Colored Buildings in Sun | 150–500 |
| Light Colored Building in Shade | 40 |
| White Beach Sand, Dry | 600 |
| White Beach Sand, Wet | 300 |
| A—Distant Scenes—Average | 300–700 |
| B—Normal Scenes—Average | 100–300 |
| C—Dark Scenes—Average | up to 80 |
| Under Trees, dense Foliage | 1–10 |

**Shutter Speeds.** The calculator is based upon shutter speeds being actually correct as marked. Frequently, however, the actual speeds differ considerably from the marked values. For particular work it is preferable to have the shutter speeds

checked if any doubt exists regarding their accuracy.

In selecting shutter speeds for any exposure the following rules should be observed:

In general, it is preferable to use as small a lens aperture, that is as high an f number as possible, in order to bring to a sharp focus all objects in front of the lens including those near it. To accomplish this it is of course necessary to use as low a shutter speed as practicable. This rule is greatly restricted, however, as soon as any object in front of the lens is in motion. In this case it is necessary to increase the shutter speed to prevent blurring the image and correspondingly decrease the f number.

## USE OF FILTERS

Color filters are frequently used over the lens to compensate for the differences between the color sensitivity of the film or plate and that of the eye, or in color process work to limit the exposure to a single color.

This always requires an increase in exposure over that indicated when no filter is used.

The multiplying constant of the filter is usually given by the maker for various kinds of plates or films and for various light sources.

To determine the correct exposure when filters are used, proceed as directed above, and then multiply the shutter time or the square of the stop number by the constant of the filter, which can be readily accomplished on the calculator by remembering that a change of one division on any part of the calculator means multiplying or dividing by approximately 1.5 and changing two divisions, by two (2). For example, if a "4 times" filter is used, and stop number f/16 at 1/32 second is indicated on the calculator for no filter, then either use the fourth division to the left on the f scale, that is f/8, which will give 4 times the exposure, or four divisions to the right on the time dial or 1/8 sec., or a combination of both by changing each by two divisions or f/11 at 1/16 sec. which will also increase the exposure four times.

Another simple way which some may prefer, to allow for filters in the exposure determination is to assume that using the filter is equivalent to reducing the film or plate speed by that factor. In this method it is merely necessary to consult Table I and divide the film speed number by the filter constant, and set the red dial arrow at the new speed value.

## COMPARATIVE TABLE
## U. S. & F. SYSTEMS

| F. | U. S. |
|---|---|
| 1.9 | .22 |
| 3.5 | .76 |
| 4.5 | 1.2 |
| 5.6 | 2 |
| 6.3 | 2.5 |
| 8 | 4 |
| 11 | 8 |
| 16 | 16 |
| 22 | 32 |
| 32 | 64 |
| 64 | 256 |
| 128 | 1024 |

## ZERO SETTING OF INSTRUMENT POINTER

When no light reaches the "electric eyes" in the back of the Exposure Meter the instrument pointer should rest directly over the zero position on the scale.

If this is not the case then the pointer can be readily set to its zero position by slightly turning the zero corrector located in the glass over the instrument scale.

When making this correction place the meter back downward on some opaque object as a card or a book so as to exclude all light from the photoelectric cells, and hold on an angle of about 45°.