FLASH
IN MODERN PHOTOGRAPHY

by WILLIAM MORTENSEN

SUPPLEMENTARY NOTES - DON M. PAUL

"Martha" *William Mortensen*

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Supplementary Notes by
DON M. PAUL

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Foreword

Photographers the last few years have been aware of a stranger in their midst. He was a sensational fellow, with manners not always of the best, and a propensity for low company; but still he seemed to be a person of remarkable talents. Photographers have been of two minds as to whether to invite him to come in and set and meet the folks, or else to ignore him as an impudent upstart.

Taking leave of allegory: many of us have been in a quandary as to what to do about flash. Many people in recent years have hopefully purchased flash equipment. But it has failed to deliver the results that they hoped for and, after a few unhappy weeks, they have discarded it. Yet they still feel that here is a photographic innovation of much value—if they could just learn to use it. They can get results of a sort, of course, but results vastly inferior, pictorially and photographically, to what they suspect that the procedure is capable of. They are in the ironic position of having a Stradivarius in their hands, but being able to elicit nothing but squeaks and squawks from it.

Flash is still new and growing, but old enough now so that we can get, if we try, some sort of perspective on it. This book is not a sales talk, or a catalogue of equipment, but an effort candidly to evaluate flash and to find a rational basis for its use.

Looking back over the brief development of flash photography, we find that it begins to divide itself into two fields:

1. Utilitarian
2. Decorative (or pictorial)

The utilitarian phase was the first to develop and still represents the most consistently fruitful application of the flash technique. In the pictorial field there has been—so far—less valuable accomplishment, but it holds much promise.

Unfortunately perhaps, there is little exchange between the two fields. Neither has had much understanding of, or even sympathy with, the ideals and purposes of the other. Realizing my own lack of knowledge in the utilitarian branch, I have enlisted the aid of Don M. Paul in presenting their case. So far as possible, it is our intent to let the experts, by means of diagrams and data sheets, speak for themselves.

It is my pleasant duty to express my thanks to many individuals and corporations for their generous help in the preparation of this book.

First of all, to all persons, too numerous to mention, whose pictures are used. For their names, look for the "by lines."

To Folmer-Graflex, Kalart and the Wabash Photolamp Corporation for permission to use contest pictures.

To Don Mohler of General Electric for valuable technical criticism.

To the publicity departments of Paramount, Universal, Warner Bros., Twentieth Century-Fox, and Columbia for permission to use numerous "stills."

To the Cameron Company for information on the clinical uses of flash.

To the Los Angeles Police Department for their cooperation.

To Roy Stryker and the Farm Security Administration photographers for outstanding examples of the applications of flash in the documentary field.

To Hansel Mieth and Otto Hagel of *Life* and *Time* for splendid examples of contemporary newsmagazine illustration.

And to all others, undoubtedly numerous, whom I have forgotten to mention.

William Mortensen
Laguna Beach, California

Part One

Chapter One

Construction of the Flash Bulb

The real protagonist of this book is the little gadget shown in Figure 1, the flash bulb.

The modern flash bulb with its precision construction and reliable behavior is long removed from the old time magnesium flash light. Yet it employs much the same principles.

The application of the combustion of metallic magnesium, in the form of ribbon, to photographic lighting is almost as old as photography itself. The first use was in 1850, when photography was very immature indeed. A refinement was introduced by powdered magnesium, which was ignited by blowing it through a flame. The next improvement appeared in the form of flash powders. In these the rate of combustion was speeded up by mixing powdered magnesium with potassium perchlorate, or other oxidizing agents, which released oxygen during the process. There was even an effort in these flash powders to make them orthochromatic by including strontium and barium salts which reduced the excess of violet of the bare magnesium flame.

All these materials, as any who have lived through them can attest, were conspicuously dangerous and uncertain. Flash light powders were in fact first cousins to high explosives, and not infre-

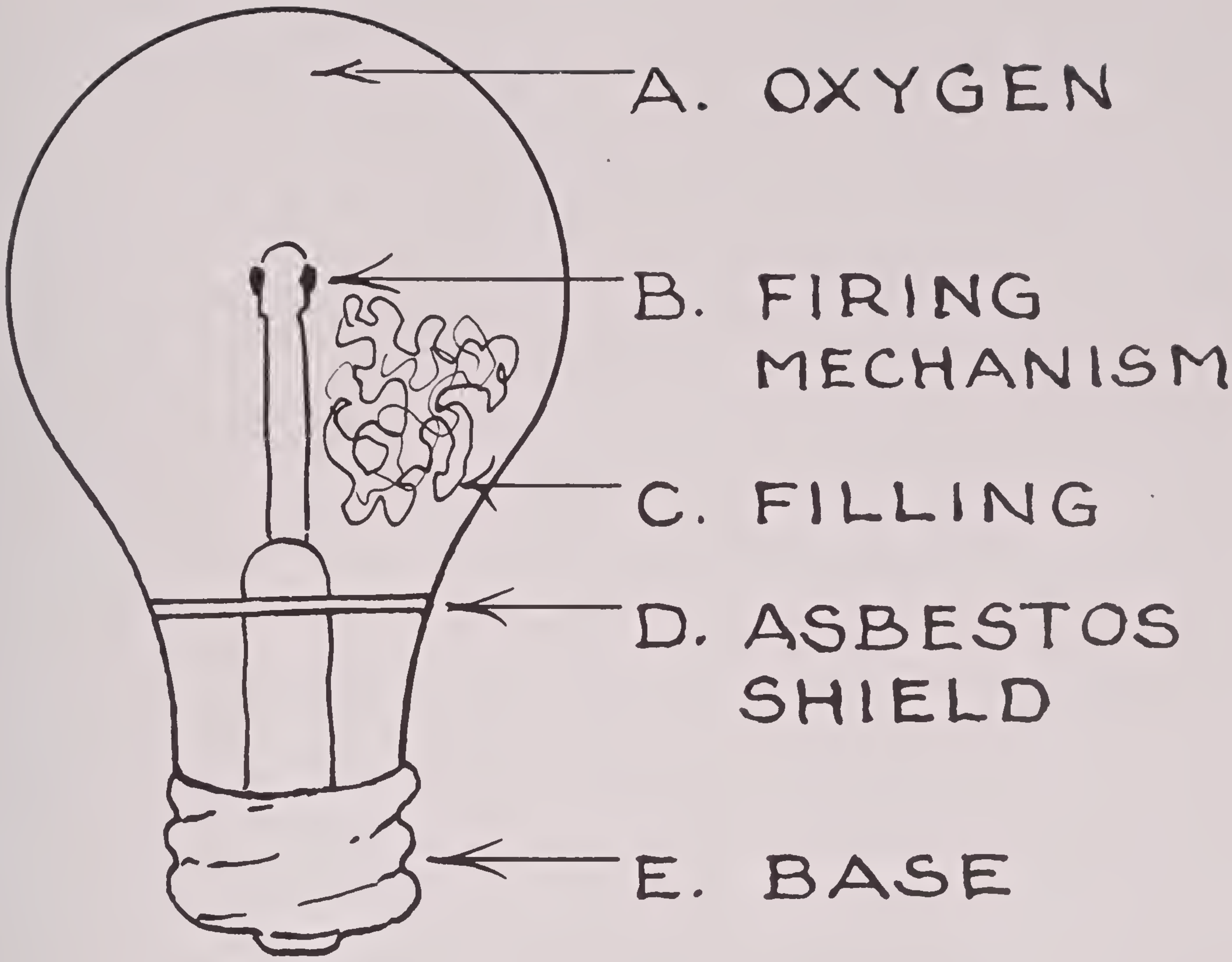

Figure 1. Meet the flash bulb.

quently blew up while being mixed, in the process of use, or even spontaneously in the container. Burns and singed eyebrows were a commonplace of flash light photography. A contemporary manual on the use of the flashlight forebodingly remarks, "It is always advisable to include a bottle of liniment and some bandages in the flashlight outfit."

Despite the fact that it was messy, dangerous, and unreliable, as well as highly explosive, flashlight powder did render good results when used "open-and-shut." Good, that is, within modest limits. The quantity of powder that was used was an arbitrary matter, based on unhappy experience. Generally a cloud of billowy, smelly smoke engulfed the room for hours after a flashlight picture was taken. Many odd devices were patented for firing the flash powder. Some of them were fairly efficient, as such gadgets go, but all were unwieldly. The commonest type was a pan, with a trigger and flint which ignited the powder. Ofttimes, in his creative ecstacy, the photographer would absent-mindedly pour powder into a hot pan, with a resultant detonation that created pandemonium, scorched whiskers, singed eyebrows, and hurled particles of glass like shrapnel through the crowds.

It seemed up to a dozen years ago that the flash technique would persist only as an anachronistic survivor of the mesozoic age of photography. And then, in Holland about 1928, this ancient procedure took a fresh lease on life. The Phillips Glolamp Works, manufacturers of incandescent lighting, noted in the course of experimentation that combustible material in an oxygen-filled glass bulb would give a flash of light when current passed through a thin filament in the bulb. Gradual development increased the light intensity, and some bright lad tied it in with the camera. At that time, however, as for almost seven years to follow, there was no uniformity in the timing of the flash. This made it still necessary to shoot pictures by the open-and-shut method, after the old tradition of flash powder.

Press photographers in America saw possibilities in this new idea and began to import these primitive flashbulbs for experimentation. In 1930, at the urging of newsmen who had tried the foreign bulbs, General Electric and Westinghouse began the manufacture of the first American-made flash bulbs. These were bulky, foil filled, and quite expensive. The news photographers used them by the open-and-shut method only, holding the bulb in a separate battery case. Inventive minds, however, soon began to figure out various means, mechanical or electrical, for synchronizing the firing time of the bulb with the opening of the shutter. Most of the synchronizers now on the market began their evolution as cumbersome, homemade contraptions on the front of press cameras. Increasing dependability and uniformity of bulb performance gave increasing importance to this phase of flash photography.

In 1936, the Wabash Photolamp Corporation placed the first wire-filled bulb on the market. This type of bulb had a somewhat longer burning peak, an improvement of considerable advantage to the amateur.

Since that time, numerous other improvements have greatly increased the safety, dependability and uniformity of all types of American flash bulbs. They are now just about as standardized in their performance as are modern film emulsions.

"Flash, 1898" *Don Paul*

The construction of a typical flash bulb is indicated in the diagram in Figure 1.

The general construction resembles that of an ordinary incandescent light. Instead, however, of a vacuum, or of inert gases, the flash bulb is filled with dry oxygen at a pressure varying from about four-fifths of an atmosphere with the G. E. bulbs to nearly three atmospheres with the Wabash product. This oxygen insures efficient combustion of the flash compound. Loss of part of the oxygen through damage or faulty construction results in excessive lag or mis-firing of the bulb.

B indicates the mechanism for firing the bulb. The two lead wires are tipped with a small amount of priming compound, which is an explosive. The lead wires are joined by a hair-thin filament. Because of its thinness, the filament has high electrical resistance, and is instantly raised to white heat by the passage of current. The heat sets off the primer, which explodes, throwing out sparks which ignite the wire or foil filling of the bulb.

In the first flash bulbs, the filling, C, was aluminum foil. Wabash introduced the use of wire for filling. The wire is an alloy, designated as "hydronalium," containing five metals. There is some difference, as we will see in the next chapter, in the behavior of wire and foil filled bulbs.

An interesting recent development among flash bulbs is the General Electric SM (which stands for Speed Midget). This bulb contains no wire filler. The sole illuminant is an extra large dose of the priming compound. Since there is no filler to kindle, the time lag is practically negligible, no greater than the lag of the shutter.

Below the filling, there is an asbestos shield, D. This protects the base of the bulb from damage by heat. It also keeps the neck of the bulb reasonably cool, so that the bulb may be removed without burning the fingers if it is grasped low on the neck.

All American-made bulbs are now provided with a safety coating. In the early days, there were numerous cases of persons being injured by flying fragments from exploding bulbs. This danger is now obviated by the device of a safety coating of transparent lacquer inside and out of the glass. The toughness of the protective coating is revealed by a simple experiment: by tapping a cracked bulb sharply with a pencil, it is possible to break the glass into tiny fragments which fall inside the bulb without fracturing the outside coating at all.

The majority of flash bulbs are made with a standard base, E. This enables them to be fitted into the standard light socket. The midget bulbs, G. E. "SM," #5 and #6 and Wabash Press-25, are, however, made with a bayonet base, similar to head-light bulbs.

Thanks to the high degree of dependability of modern flash bulbs, relatively few failures are traceable to the bulbs themselves. We should note, however, the sources of these infrequent functional failures.

1. Loss of oxygen. An excess of oxygen is essential to the efficient combustion of the foil or wire filling. Loss of oxygen causes excessive lag or even misfiring of the bulb. The Wabash bulb has an ingenious device to show when the bulb lacks proper oxygen content. This consists of a small spot of cobalt salts in the tip of the bulb. In a proper concentration of oxygen, this spot is bright blue. It fades, however, to pink when the oxygen is depleted.

2. Broken filament. Heavy jars or faulty construction may lead to the breaking of the filament. Ordinarily, the breaking of this filament will lead only to the misfiring of the bulb. In exceptional conditions, however, a broken filament may be a source of danger. If the filament is broken but still loosely in contact, passage of the current may produce an arc, resulting in the combustion of the lead wires, with explosion of the bulb, and burning metal thrown out through the glass. This type of accident, it should be said by way of reassurance, is very rare indeed. The condition of the filament may be accurately checked only by the use of a neon test lamp.

3. Lack of uniformity. Uniformity of behavior is the very postulate of flash photography. The photographer must know in advance just what his flash bulb will do, and be absolutely certain that it will deliver the goods. The modern American flash bulb is, fortunately, extremely uniform in its behavior, for there are no cheaply made competitive goods to bring down the standards.

Chapter Two

The Behavior of Flash Bulbs

In the preceding chapter we considered the construction of the flash bulb. We come now to consideration of its habits and behavior.

The Cycle of the Flash.

When we set off a flash, we are conscious only of a brief flare of light, lasting rather less than the proverbial "twinkling of an eye." But if we put this extremely brief procedure under a microscope as it were, or subject it to a slowing down process, we find that there is considerable going on. Let me ennumerate, in order, the things that happen from the instant that the button is pushed and the current passes through the bulb.

1. Current passes through filament.
2. Filament becomes white hot.
3. Filament breaks. Current stops flowing through lamp.
4. Almost instantly the primer explodes.
5. Lag while wire or foil filler ignites.
6. Flash begins.
7. Flash builds in brightness.
8. Flash reaches peak of brightness.
9. Flash dies away.
10. Flash ceases.

Here is a sequence of ten procedures at least, all taking place within that period of time usually described as "an instant." Actually, the total duration of time involved is somewhere near one-twentieth of a second. These are microscopic time intervals, but in photography, as in modern industry, efficiency depends upon punctillious handling of very small elements. Micrometric accuracy in timing is needed to make efficient use of the illumination of the flash bulb.

To properly appreciate the relationship of such microscopic time intervals, it is necessary to put them under some sort of magnifying glass. This is best done by graphic representation. But before we construct our graph, we must pause a moment to define our terms of measurement.

Terms Defined.

There are three technical terms that need to be understood in any discussion of the behavior of flash bulbs.

1. The first of these is *millisecond.* A millisecond is simply *one-thousandth of a second.* The term is used because a second is much too large a unit for use in dealing with such small intervals of time.
2. The second term is *lumen.* The lumen is the universal measure of light. It is officially defined as the amount of light passing through a unit solid angle (one steradian) from a point source of one candlepower at the apex of the angle. This "unit solid angle" business is rather technical, but it may be approximately visualized as follows: imagine a light source of 1 candlepower shining through a one-foot-square hole in the wall, every corner of the hole being one foot distant from the light. Under these conditions, the amount of light passing through the hole would be about 1 lumen. Note that the lumen measures the *amount* of light, not its brightness or illuminating power. Thus the square beam under consideration would be only 1/16 as bright at 4 feet from the source, but the whole beam would still comprise 1 lumen.*

* The measure of illumination or light density, however, is tied in closely with the lumen. Illumination is customarily measured in "foot candles," the unit which appears on the G. E. photocell light meter. A "foot candle" means 1 lumen per square foot of area.

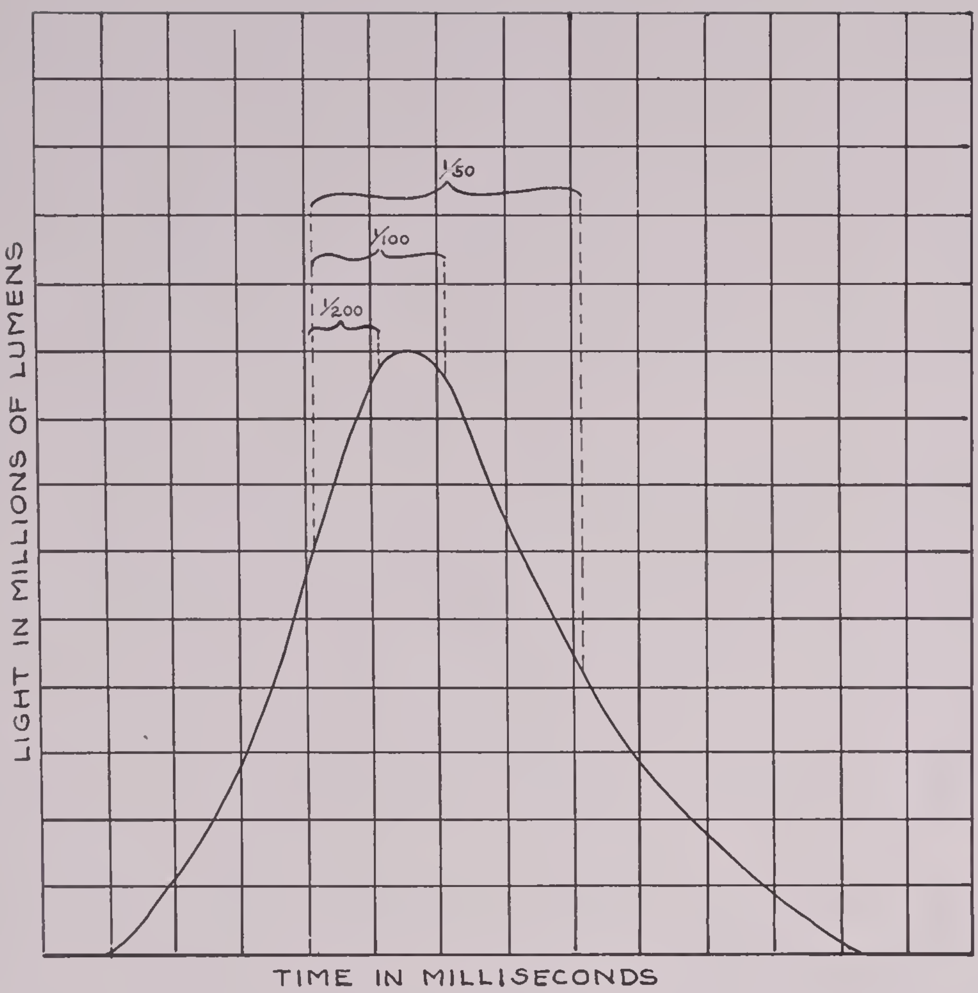

Figure 2.

Typical curve of flashbulb performance. Each horizontal division indicates a duration of five milliseconds (1/200 of a second). Each vertical division indicates a light output of one-half million lumens. The brackets show the portions of the curve usually embraced by synchronized exposures of 1/200, 1/100, and 1/50 respectively.

3. The third unit, slightly more complex, is the *lumen-second.* A lumen-second consists of one lumen lasting for one second. Ten lumen-seconds could be either one lumen for ten seconds or ten lumens for one second. The lumen-second is thus comparable to such units as the "man-hour": a given job of work, let us say, may be done by one man in ten hours, by two men in five hours, or by ten men in one hour. The lumen-second is readily understood by the photographer in terms of exposure: an identical exposure would be secured by illuminating with ten candles for one second or with one candle for ten seconds.

Graphic Representation of Flash Behavior.

The behavior of the flash bulb is ordinarily represented on a graph such as Figure 2. Here the intensity of the light (in millions of lumens) is plotted on the vertical axis. The horizontal axis of the graph represents (in milliseconds) the time elapsed. The graph thus represents the brightness of the flash for every millisecond during

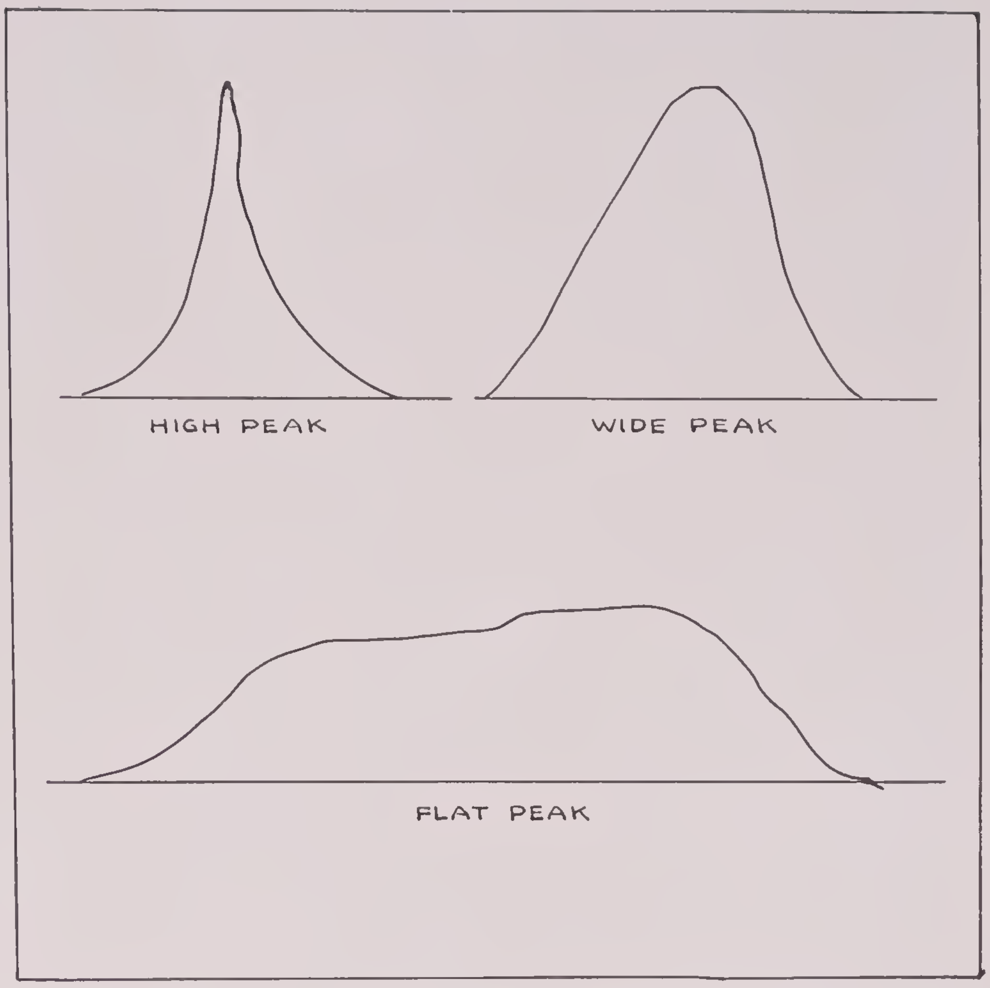

Figure 3.

Three types of flash peaks, characteristic respectively of foil-filled bulbs, wire-filled bulbs, and bulbs especially designed for use with focal-plane shutters.

its duration. The total output of light is represented by the *area under the curve*—since, as we have seen in the definition of terms, lumen-seconds equal lumens multiplied by seconds.

The curve shown in Figure 2 is typical of flash bulb performance. Note the general trend of the curve: the bulb does not kindle until about 5 milliseconds after the current is turned on; it takes about 10 more milliseconds to get going; at 20 milliseconds, it is really under way; and at about 20 to 25 milliseconds it reaches its *peak*, or point of maximum brightness. Beyond the peak, the curve falls away in a similar contour, and in about 50 milliseconds from the instant the current is turned on, the bulb is dead. Certainly a brief career, but an exciting one.*

Comparing curves of performance, we may note three general types (Figure 3):

1. High peaks
2. Wide peaks
3. Flat peaks.

* Even more transitory is the life cycle of the General Electric Speed Midget (SM) bulb. It kindles almost instantly and reaches its peak in only 5 milliseconds. In about 12 milliseconds, its brief race is run. Because of its quick starting, this bulb presents a special problem in synchronization.

The flat peak is characteristic of the bulb specially designed for focal plane shutters (General Electric #6 and # 31, Wabash #2A). High peaks and wide peaks are characteristic respectively of foil-filled and wire-filled bulbs. The foil-filled bulb is slower in starting, but rises more quickly to its peak, than does the wire-filled type. Thus the G. E. No. 21 (foil-filled) does not kindle until about 12 milliseconds, but it reaches its peak in 20 milliseconds. On the other hand, the G. E. No. 16A (wire-filled) starts at 5 milliseconds and reaches its peak in about 22 milliseconds. In the larger Wabash bulbs (which are all wire-filled) the peak is delayed to 26 or 27 milliseconds.

All factors must be considered in judging the performance of a bulb. Mere brightness does not tell the tale; often the total output is more important. Thus the G. E. No. 21 reaches the terrific peak of 4½ million lumens, but its total output is considerably less than that of the No. 31, which barely reaches 1½ million lumens at its peak. For open-and-shut shots, or for closely synchronized short exposures, the high-peak, foil-filled lamps have their place; but for all-round use, particularly in the hands of amateurs, the wider-peaked wire-filled lamps are to be more generally recommended.

Manufacturer's Analysis.

As a supplement to this chapter, we include the manufacturers' descriptions and data on General Electric and Wabash flash bulbs.

Wabash Superflash Bulbs.

Superflash Press 25—The most powerful midget flash bulb ever made, in a new "even-light" shape scientifically designed for maximum efficiency with standard as well as "concentrating" reflectors. To be used on 1.5 to 9 volts only, not on house current.

Superflash No. 0—The powerful baby flash bulb and the largest-selling baby size for all amateur use, especially with the new built-in flash cameras. Its wide-peak flash has the same carefully controlled characteristics as the other Superflash sizes, and is guaranteed for synchronized use.

Superflash Press 40—Now 30% to 65% smaller than ordinary flash bulbs of the same light output. Extra-power "long-peak" light flash as-

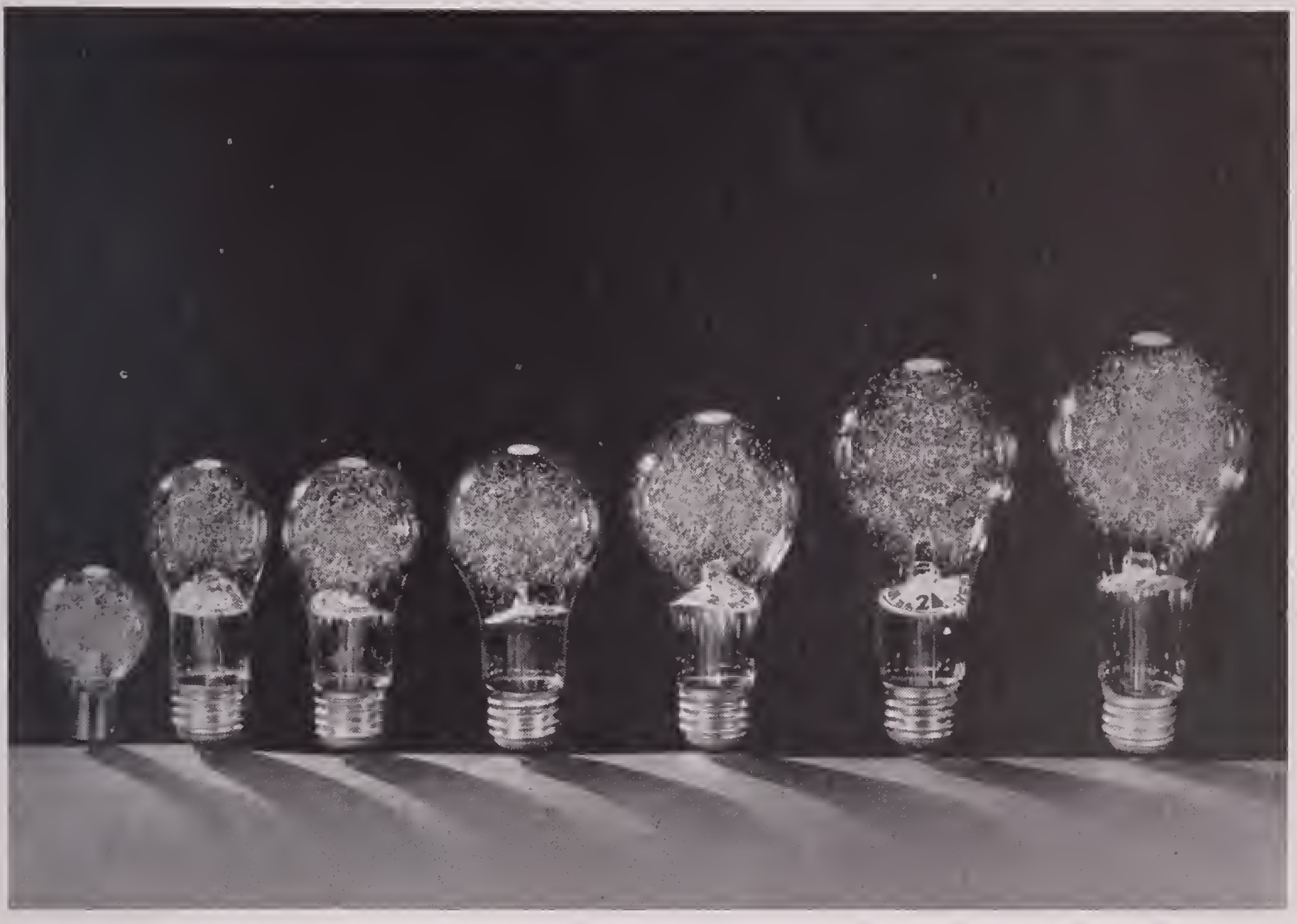

Figure 4. The Wabash family. Left to right: Press 25, No. 0, Press 40, Press 50, No. 2, No. 2A, and No. 3.

sures perfect, foolproof high speed synchronizing, plus use for focal plane minicameras. Carefully controlled timing and flashing characteristics. Light output is 43% to 100% greater than same size ordinary bulbs.

Superflash Press 50—An extra-power professional "press" bulb in the same synchronization band as the Press 40. Has high-powered, extra peak-light flash, controlled uniformity, guaranteed split second synchronization at high shutter speeds, plus the advantage of 25% greater light output than any ordinary flash bulb of the same size.

Superflash No. 2—A high-powered bulb recommended for synchronizing with all compur or between-the-lens shutters, and for some focal plane minicameras. Timing and flashing characteristics controlled within closest limits assuring uniform results especially when wired in series or multiple circuits for banquet shots, etc.

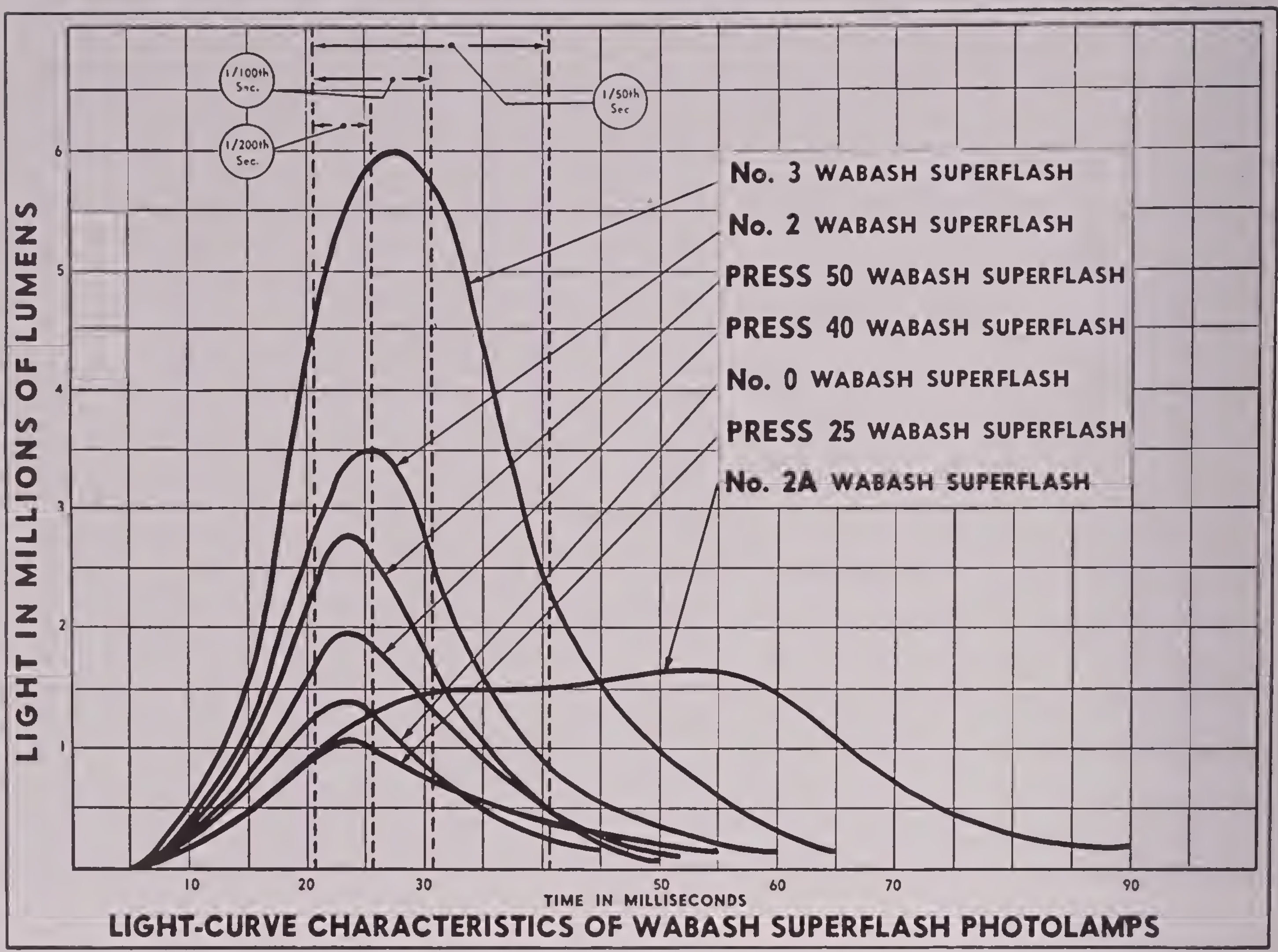

Figure 5.

Superflash No. 2A—For use with focal plane cameras only and not for compur or between-the-lens shutters. Made with an unusually long "plateau-peak," assuring high-speed synchronized action shots at speeds up to 1/1000th of a second with the large focal plane back shutters as on the 4x5″ Graflex and Speed Graphics.

Superflash No. 3X (not illustrated)—A new, high-powered professional size that develops a broad-peak flash that is ideal for penetrating distance and for covering large, wide areas as in stadium scenes, large halls and industrial plants, crowds, training station and airport scenes, etc. Is in the same synchronization band as the No. 3, and is precision-timed for multiple flash work in black and white as well as in color. Same bulb size as the No. 2A.

Superflash No. 3—The most powerful flash bulb capable of synchronizing. Especially recommended for multiple flashing and wide-area banquet shots. To get maximum effectiveness of extra peak light flash duration, synchronizing is recommended at speeds up to 1/100th of a second; no relays or accessories required.

	Press 25	No. 0	Press 40	Press 50	No. 2	No. 2A	No. 3X	No. 3
Total Light Output Lumen Seconds	25,000	25,000	40,000	50,000	70,000	80,000	110,000	140,000
Peak Lumens	1,100,000	1,400,000	2,000,000	2,800,000	3,500,000	1,700,000	4,500,000	6,000,000
Time to Start of Flash — milliseconds	7	7	7	7	7	7	7	7
Time to Peak of Flash — milliseconds	23	23	23	23	25	23	26	28
Effective Flash Duration — milliseconds	40	30	37	37	47	70	51	55
Duration Above 50% Peak — milliseconds	20	16	18	16	17	50	19	21
Voltage required for Flash — volts	1.5-9	1.5-125	1.5-125	1.5-125	1.5-125	1.5-9	1.5-125	1.5-125
Aver. Current to Flash Lamps — amps.	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Max. Instantaneous Current Battery — amps.	2	2	2	2	2	2	2	2
Color Temperature — Degrees Kelvin	4,000°K	4,000°K	4,000°K	4,000°K	4,000°K	4,000°K	4,000°K	4,000°K
Overall Length — Inches	2-3/8	3-13/16	3-15/16	4-1/16	4-3/4	5-3/8	5-3/8	6-5/8
Bulb Shape	B12	S13	A15	A17	A19	A21	A21	A23

Table I

Color Flash Bulbs

These four self-filtering blue Superflash bulbs are designed for use with color film only. Exposure data is given in Chapter 4. Light output figures in Table II are arbitrary figures for a comparative basis in computing exposures.

New Superflash No. OB — Made in the same bulb size as the Standard No. O.

New Superflash No. 40B—In the same bulb size as the standard Press 40.

Superflash No. 2B — In the same bulb size as the standard No. 2.

Superflash No. 3B — In the same bulb size as the standard No. 3.

	No. 0B	No. 40B	No. 2B	No. 3B
Total Light Output in Lumen Seconds	12,000	18,000	42,000	85,000
Time to Start of Flash—Milliseconds	7	7	7	7
Time to Peak of Flash—Milliseconds	23	23	25	28
Effective Flash Duration—Milliseconds	30	37	47	55
Duration Above 50% Peak—Milliseconds	16	18	17	21
Voltage Required for Flash—Volts	1.5-125	1.5-125	1.5-125	1.5-125
Aver. Current to Flash Lamps—Amperes	0.25	0.25	0.25	0.25
Max. Instantaneous Current Battery—Amps.	2	2	2	2
Color Temperature—Degrees Kelvin	6000°K.	6000°K	6000°K	6000°K

Table II

Figure 6. The General Electric family. Left to right, SM, No. 5, No. 6, No. 11, No. 16A, No. 21, No. 21B, No. 31, No. 50.

General Electric Photoflash Lamps.

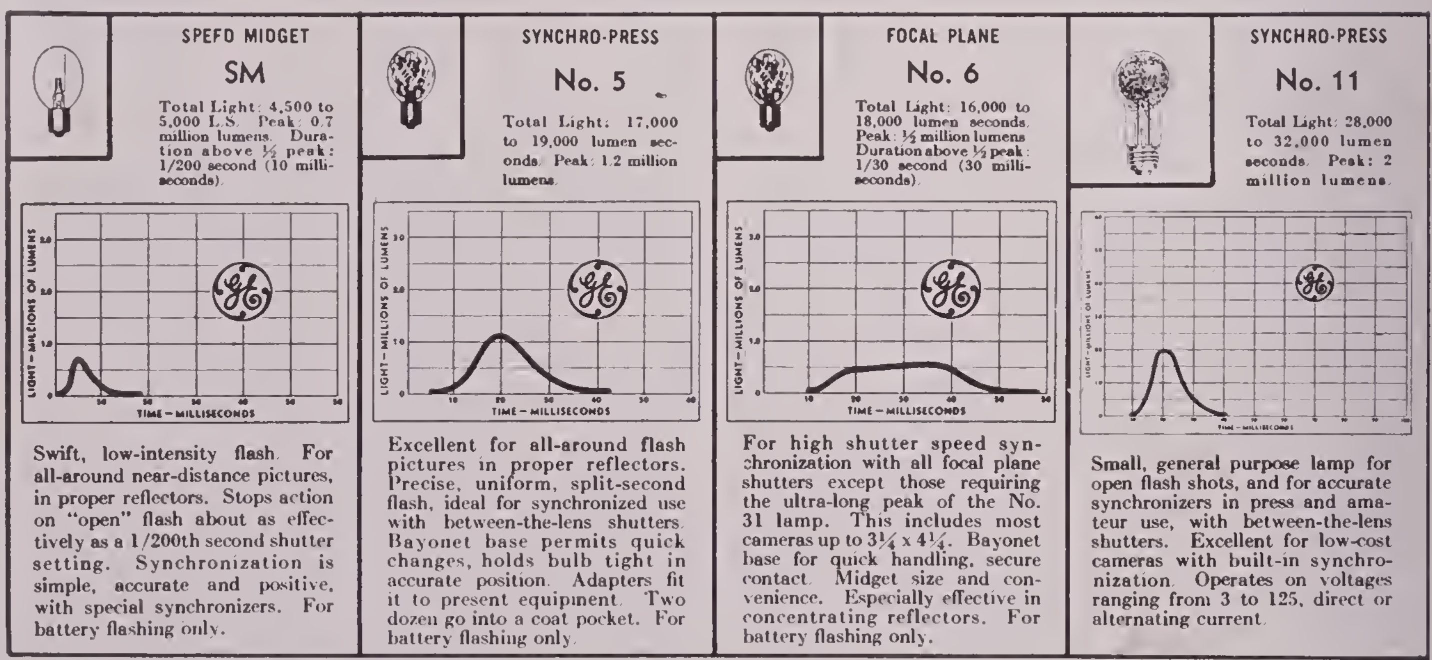

Figure 7. Data on G. E. "Photoflash" lamps SM, No. 5, No. 6, and No. 11.

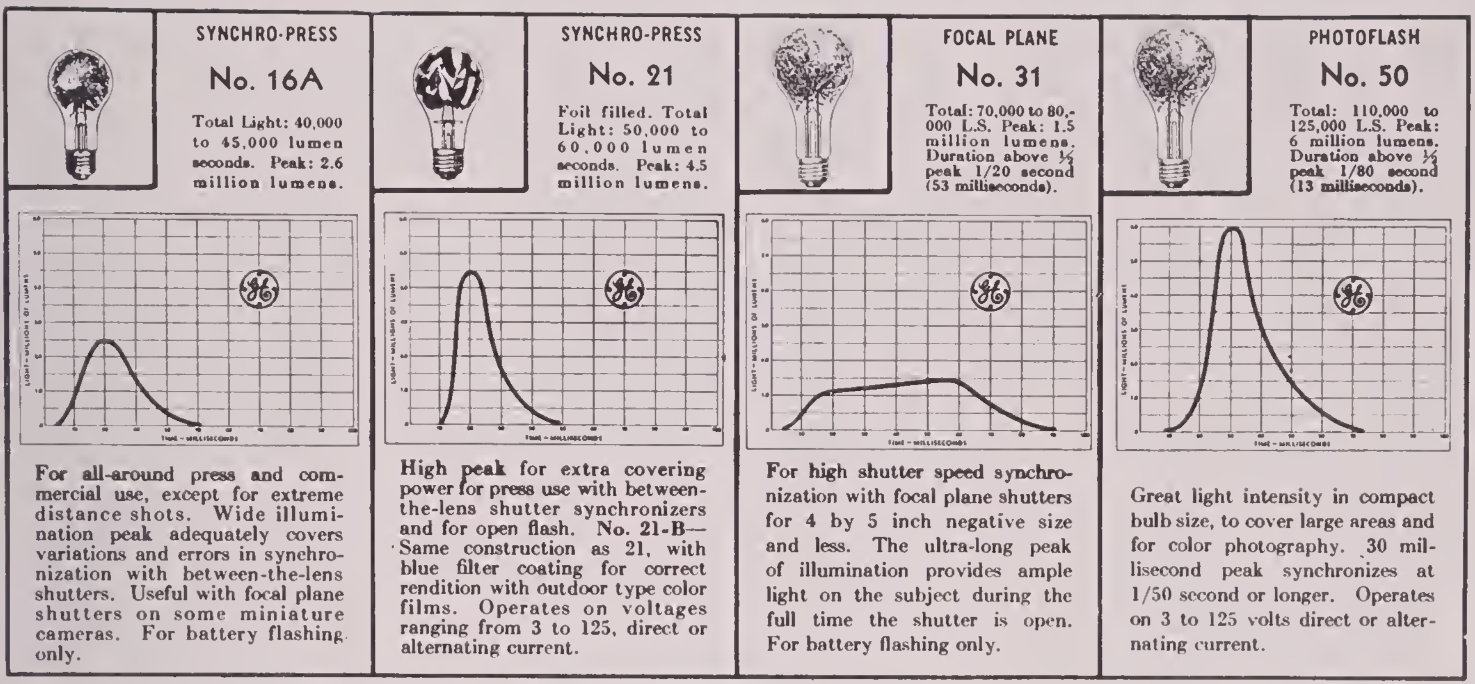

Figure 8. Data on G. E. "Photoflash" lamps No. 16A, No. 21, No. 31, and No. 50.

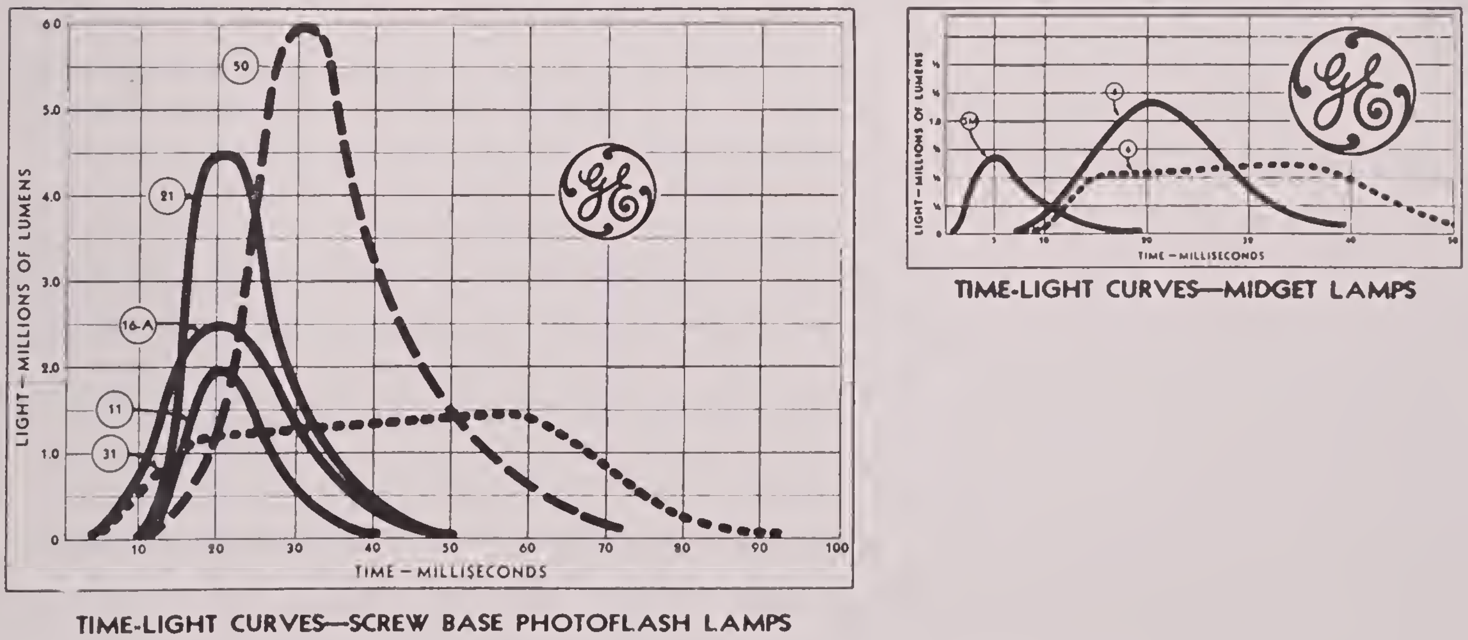

Figure 9. Time-Light characteristics of G. E. "Photoflash" lamps.

Chapter Three

The problem of synchronization

In the early days of the flash bulb, it was used only by the "open flash" method. This is the simplest way of using the flash. It requires no additional equipment aside from a flash bulb and an ordinary flash-light battery. (See Figure 10.) It is inexpensive and available to any amateur with any sort of camera. One simply sets the shutter at "Time," opens the shutter, flashes the bulb, closes the shutter.

The "open flash" is, of course, a hold-over from the old days of flash powder, which was used in the same manner. And the open flash is useful only under the same conditions in which the flash powder was used: night time or subdued light, so that the only effective exposure is that furnished by the flash.

The really productive field of the flash bulb, however, is that made available by *synchronization.*

What do we mean by "synchronization"? Broadly speaking, synchronization means simply the exact *coordination of shutter action and flash action so that they arrive at their full efficiency simultaneously.*

Off-hand this might appear to be a simple mechanical problem. But it is not quite so simple as it looks. Neither flash nor shutter operate instantaneously. It takes a flash bulb about 20/1000 of a

Figure 10.
The Open Flash or "Open-and-Shut."
Photo by Rus Arnold.

second to reach its peak illumination: a good between-the-lens shutter, however, is full open in 6/1000 of a second. So we see that the problem of synchronization is a little more complicated than it appears at first sight.

By way of rough analogy, the problem might be stated as follows. You have two horses, Flash and Shutter. Flash, belying his name, is the slower beast; in fact, Shutter is about three times faster than Flash. However, for your purposes, you wish them to run a course and both to reach the wire at the same time. How would you manage it? The obvious procedure would be to send the slower Flash on his way first, and when he had run about two thirds of the course, send along the more zippy Shutter. Handled this way, the two ponies would arrive at the finish simultaneously.

In rough terms, the above action is exactly that accomplished by all synchronizing devices: by various means, depending upon the type of synchronizer used, the shutter action is delayed until the slower acting flash has time to get under way. The actual intervals of time involved are very small indeed, so the amount of delay must be determined with extreme accuracy.

The Behavior of Shutters.

Since, in the modern use of the flash, the burning of the flash bulb is either mechanically or electrically "geared" to the action of the shutter, the behavior of the shutter is an important part of the problem of synchronization.

When we look through old manuals of photography, we are struck by the large number of quaint and curious gadgets that have, in earlier ages of the art, been made to serve as shutters. But so far as modern cameras are concerned, shutters may be reduced to two general types:

1. The between-the-lens shutter.
2. The focal plane shutter.

The basic principles of the two are widely different and offer quite different problems in synchronization.

The so-called *between-the-lens shutter* is built between the elements of the lens in a position as close as possible to that of the diaphragm. At this position, the bundle of beams making up the image is at its narrowest. This is an efficient position, since a fairly small opening serves to admit all the light passing through the lens. A shutter in this position is usually, like the diaphragm, of iris construction, opening from the center. This ensures equal illumination of all points of the image at all times during the exposure, even when the lens is barely opened or almost closed.

An iris type of shutter is subject to considerable loss of efficiency when working at higher speeds. At a hundredth of a second, let us say, the shutter takes most of its time in opening and closing, and thus is wide open for only a couple of thousandths of a second. In view of this discrepancy, manufacturers always mark their shutters in terms of equivalent *light values* rather than actual *time values.*

That is to say, if your shutter is set at 1/100, the actual time from opening to closing will be considerably longer than 1/100 of a second. But the amount of light admitted will be the same that would be admitted if the shutter were wide-open for 1/100.

Some added discrepancy is introduced with lenses so compensated when operating at reduced apertures, when the exposure seems greater than marked. This is because the iris of the shutter reaches the opening corresponding to the reduced aperture much more quickly than it does the full aperture.

Owing to its lowered efficiency at high speeds, and also to the mechanical difficulties involved, this type of shutter is rarely made to furnish exposures less than 1/400. For extremely short exposures, recourse is had to the focal-plane type.

The *focal-plane shutter* is built so as to operate as closely as possible to the plane of the sensitive emulsion. This is an efficient position for the shutter, since it is the point at which the *individual* beams making up the image are narrowest. In its usual form, the focal-plane shutter consists of a slitted curtain moving in front of the emulsion. Length of exposure is varied by controlling both the speed of the curtain and the width of the slit.

Under ordinary conditions of light, the focal-plane shutter is nearly one hundred per-cent efficient. Its peculiar action, however, makes it less readily synchronized than the between-the-lens type. Instead of exposing the image to the emulsion all at once, as with a between-the-lens shutter, the focal-plane type wipes the image across the plate. The peculiar problem in synchronization thus involved is discussed a little later in this chapter.

Types of Synchronizers.

Synchronizing devices are broadly classified as *manual, mechanical* and *electrical.* This classification is apt to be a little confusing at first glance; for, obviously, electrical action is needed to set off the bulb in any type of synchronizer, and some sort of manual action is needed to punch the button. These terms, "manual," "mechanical" and "electrical" should be understood as referring to the method by which the *shutter* is operated.

In the manual type, the shutter is tripped by the direct action of the hand-operated cable release, which first makes contact for the bulb and then moves on to actuate the shutter. This is the simplest and least expensive of all synchronizing devices, and is the basis of the operation of low-priced cameras with built-in synchronizers. It is dependable and positive in its action, but is not extremely accurate. The time lag in a manual type of synchronizer may be materially altered by the way in which the cable release is operated. If the release is pushed down abruptly, the bulb may fire too late; and if it is operated gently, the bulb may fire too soon. An even and constant pressure is required for its consistent operation. The manual type is not generally capable of synchronizing shutter speeds higher than 1/100.

A partial list of manual type synchronizers now in the market:

Chardelle "Meteor"
Fey
Flash King
Hipco
Kodak Junior Synchronizer
Victor

In the mechanical type of synchronizer, the cable release simultaneously makes contact for the bulb and sets off a time-consuming mechanical action. In the Kalart device, for example, there is a little fly wheel which spins and, at the end of its revolution, operates the shutter. At is best, this type is reasonably priced and thoroughly accurate for speeds as high as 1/500.

Mechanical types now on the market include the following:

Hipwell
Kalart

The electric type of synchronizer is operated by an electric button which simultaneously makes contact for the bulb and the solenoid coil (usually mounted on the lens board) which actuates the shutter. When properly adjusted, the electrical type is extremely accurate for speeds as high as 1/1000. It is, however, subject to electrical quirks. Operation of the solenoid coil draws more current than the mere firing of bulbs, so the batteries become rapidly depleted. Weak batteries or bad connections may seriously upset the synchronization.

Two typical synchronizer set-ups.

Figure 11. Zeiss Super-Ikonta B with Kalart Automatic Speed Flash (mechanical type of synchronizer).

Figure 12. Speed Graphic with Abbey Flash-gun (electrical type of synchronizer).

Standard makes of electrical synchronizers include the following:

Abbey
Folmer-Graflex
Heiland Sol
Mendelsohn

Unfortunately, almost every make of shutter requires individual adaptation of the synchronizer. Some shutters operate on a short stroke, others on a long stroke; some are stiff in their action, others very soft. All these peculiarities make a genuinely universal type of synchronizer an impossibility.

Concerning the relative virtues of these devices, their installation and adjustment, this book offers no suggestions. These matters are between you and your dealer.

Fitting the Shutter to the Curve.

Figure 2 shows the conventional graphic representation of the performance of a typical flash lamp. The horizontal axis represents the time, in milliseconds, from the instant that electrical contact is made. The vertical axis represents, in millions of lumens, the amount of light put forth. Each single point on the curve represents the brightness of the bulb at a particular moment in its cycle.

Look now at the contour of the curve. For five milliseconds there is nothing doing. Then the filler in the bulb catches fire. For the next five milliseconds it barely simmers. In the third five milliseconds it begins to warm up a bit. From fifteen to twenty milliseconds it is climbing rapidly. Finally, twenty to twenty-five milliseconds after the contact is made, the flash reaches its peak.

Passing the peak, the flash fades in about the same rhythm with which it grew. About fifty milliseconds after the current was turned on, it dies away completely.

Synchronization is usually adjusted so that the shutter opens at the twentieth millisecond, just as the curve goes into its final steep climb toward the peak. An exposure of 1/200 of a second (5 milliseconds) includes, therefore, the light available between this point and the peak of the flash. This amount (see Figure 13) is about 25% of the total output. An exposure of 1/100 of a second (10 milliseconds) includes also a nearly equal amount on the other side of the peak, about 55% of the total. And an exposure of 1/50 of a second (20 milliseconds) runs well down into the tail of the curve and utilizes about 85% of the output.*

Note that the short exposures get the "cream of the crop." Although 1/50 of a second is four times as long as 1/200, it gets only 2½ times as much light. Failure to allow for this fact is a frequent cause of discrepancies in exposure.

Fitting the Curve to the Shutter: The case of the Focal Plane.

The focal plane shutter offers a special problem in synchronization. With shutters of the between-the-lens type, the whole plate is exposed at once. The exposure with the focal plane type, however, is a sort of wiping action, in which one edge of the picture is exposed before the other. This discrepancy is not ordinarily apparent in the results, except in the case of very rapid action in the subject (which may produce peculiar distortions) and in the case of synchronized

* These generalizations do not apply to the G. E. "SM," which utilizes 70% of the light at 1/200 and 100% at 1/100 or slower.

Figure 13. Comparative effectiveness of exposures of 1/200, 1/100, and 1/50.

flash (which may produce uneven illumination). It must be remembered that the total time it takes the slit in the focal plane shutter to move across the plate is considerably longer than the exposure time given to any one point on the plate. The slit must accomplish its transit within the brief period of the bulb's full efficiency: otherwise, the negative will be more heavily exposed toward one edge than the other.

Contax cameras, in which the shutter moves across the shorter dimension of the frame, may be successfully synchronized with such bulbs as Wabash 40 and 50 or G. E. 16A and #5. In Leica cameras, the shutter moves on the longer dimension. They require bulbs with slightly longer peak such as Wabash 50 or #2, or G. E. #6, #31.

Larger reflex cameras, in which the shutter slit has a long way to travel, require under ordinary conditions* a bulb of extra long peak, specially designed for focal plane use. (See Figures 5 and 9.) Such special bulbs are the G. E. No. 31 and the Wabash 2A.

* It is commonly considered impossible to synchronize a large Graflex with an ordinary flash bulb. It IS impossible with the camera as usually adjusted. However, a fairly simple readjustment, providing a wider slit and heavier tension in the curtain, make it entirely feasible to synchronize a 4x5 Graflex with a midget bulb.

Chapter Four

The Problem of Exposure with Flash

In flash photography, as in all branches of photography, a very touchy and treacherous problem is that of exposure. Exposure is the very crux of that interlocking series of procedures that we call photography. If exposure is wrong, everything that goes before it, and everything that comes after it, is largely invalidated. If your exposure is wrong, there is really nothing to be done about it; "Nor all your piety or wit"—nor all your chromium intensifiers or Farmer's reducers—"shall lure it back to cancel half a line"—or make a decent picture out of it. For the purposes of good photography, there is nothing quite so advantageous as a correct exposure, nor is there any adequate substitute for it.

So make up your mind that you must have a good exposure. Otherwise, it really doesn't matter what kind of a camera you have, what kind of film you put into it, what sort of synchronizer or what size of bulb you use; nor does it matter what you develop your film in, how you print it or how you mount the result. Briefly, without correct exposure, nothing matters.

Unhappily, whenever any new gadget is being tested, or any new photographic wrinkle is being tried out, enthusiastic amateurs lose all sense of proportion and photographic values. A great deal of photographic experience runs along these lines: when the beginner gets his first camera, he will settle for nothing better than a barely recognizable image; when he gets around to the matter of fine grain (a few months or years later), he gets fine grain, or else—whether the negative will print or not is not anything to bother his pretty head about. So, when our man takes up flash, he is well content if the flash goes off as specified and he gets some sort of mark on his negative to show that the event has taken place.

But flash, like any other photographic innovation, must justify itself photographically if it is to become a permanent part of photographic procedure. Flash cannot wholly justify itself by mere stunt pictures—pictures that could not be comfortably gotten in any other way; rather it must justify itself the hard way—by the severe test of photographic quality. It is a hard fact, but a distressingly high percentage of the pictures offered in evidence by the flash manufacturers are not so hot photographically. They show you the use of the flash, to be sure, but they *don't* show you good photographic technique.

Of all photographic errors evinced in flash pictures, the most frequently encountered is bad exposure. There are two things that make exposure a particularly touchy problem in flash. In the first place, the volume of light put out by the flash bulb is almost unbelievably high. The Wabash "Press 40," for example, is a medium-sized bulb in common use. Among household globes, a 100-watt lamp rates as pretty bright. But it would take fifteen hundred of these 100-watt lamps to equal the light output of the peak of the flash of the Press 40. And at seven feet from the subject, this bulb is approximately as bright as the noonday sun.

With such potent sources of light at hand, it is small wonder that we go widely astray in our exposures at first. Having a light source of such astronomical volume hitched right to your camera provides you with an embarrassment of power and you feel rather like one who sets out to lift a tea cup with a blast of TNT. It can be done, but knowledge and control must be brought to bear.

The other element that contributes heavily to bad exposures with flash is the rapid falling off of illumination with increasing distance from the flash bulb. Never so clearly demonstrated is the old rule of inverse squares as in the use of flash: at double the distance, your subject gets only one quarter as much light; and at four times the distance, it gets but one-sixteenth as much. And the closer you get, the more noticeable is the discrepancy. Efforts at compromise result in those pictures so unhappily common in the annals of flash photography, with foreground over-exposed and background under-exposed.

Eight Factors.

The control of exposure with flash is not a simple problem. It involves the interaction of at least eight factors. Six of these factors concern your equipment and its operation:

1. Film speed
2. Size of flash bulb (and number used)
3. Distance from bulb to subject
4. Type of reflector
5. Shutter speed
6. Diaphragm opening.

The other two factors concern the quality of your subject matter:

7. Reflecting surfaces surrounding your subject.
8. Colour and texture of subject matter itself.

1. *Film speed.* Because flash is a speed process, there is a sympathetically induced inclination to use nothing but high speed films in connection with it. To do this, however, is to sacrifice photographic quality: for the hyper-extra emulsions are necessarily lacking in the best gradation and half-tones and, for miniature use, have noticeably larger grain. Rather one should take advantage of the higher speed of the flash by using as *slow* a film as possible. Properly used, flash has the effect of speeding up a slow film while still retaining its superior quality. Except, therefore, in cases where speed is the essential issue, make no departure from the film you customarily use when you want the best of photographic quality—preferably a film of no higher a Weston rating than Tungsten 32.

2. *Size of bulb.* Flash bulbs are now available in a wide range of sizes. In the Wabash line, the bulbs vary from the midget Press-25 (at 1 million lumens) to the No. 3 (at 6 million lumens). (See Figure 4.) In the General Electric line, bulb sizes vary from the Speed

Midget "SM" (at half a million lumens) to the super-colossal No. 75 (at 10 million lumens). (See Figure 6.)

The average amateur, however, will have no occasion to employ the full range of sizes. To attempt it would probably bring him to a state of complete confusion. Let him instead pick out about three sizes of varying power and learn how to use these consistently and intelligently. In the Wabash line I would suggest the following:

Press-25 (or No. 0)	25,000 lumen seconds
Press-40	40,000 lumen seconds
No. 2	70,000 lumen seconds

And in the G. E. line:

No. 5	17,000 to 19,000 lumen seconds
No. 16A	40,000 to 45,000 lumen seconds
No. 21	50,000 to 60,000 lumen seconds

And for focal plane use:

Wabash No. 2A	80,000 lumen seconds
G. E. No. 31	70,000 to 80,000 lumen seconds*

This range of bulbs is sufficient to meet ordinary flash needs. A good general rule to follow in fitting the bulb size to the use is the following: When in doubt, use the smaller bulb. Far more flash pictures have been spoiled by too much light than by too little.

It might seem advantageous for the photographer to limit himself to a single size of flash bulb and thus simplify and standardize his technique. Theoretically, this would be an ideal procedure, but it does not work out in practice. A weak bulb, for example, would not have sufficient power for anything except close-ups. On the other hand, using a large bulb for a close-up is a wasteful procedure. Indeed, the average lens does not close down far enough to avoid over-exposure when a large bulb is used at close quarters.

3. *Distance from bulb to subject.* We shall often have occasion in this book to refer to "the law of inverse squares," the fact that at 2 feet from the light source you get just one-quarter as much light as at 1 foot, at 4 feet you get one sixteenth as much, while at 10 feet you get only 1/100 as much. This means that exposures are very strongly affected by seemingly slight alterations in distance, particularly when working close in.

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* Above ratings according to manufacturers' specifications.

Distance is thus a very important means of controlling the flash. In multiple-flash and sun-plus-flash combinations, as we shall see, distance is the principal factor in establishing proper balance between the several sources.

With a single flash, distance multiplied by F: number gives a constant product. This convenient fact makes possible the use of the "flash numbers," which appear in the following exposure tables. For example, if for an exposure of 1/200 the "flash number" is stated as 160, a flash distance of 10 feet would call for F:16, 8 feet would call for F:20, and 4 feet would call for F:40.

4. *Type of reflector.* The reflector plays a more important part in flash photography than is generally realized. With flash lamps of the standard screw base type, the average flat reflector such as is furnished with the synchronizer will increase the light reaching the subject 2 to 5 times over that given by the bare lamp. Reflectors specially designed for use with midget bulbs are much more efficient and increase the light on the subject from 6 to 15 times. The most efficient are those of the so-called "rifle-beam" type, which concentrate the light in an approximately 30 degree beam.

The more nearly the light source approximates the optical ideal of a "point source," the more nearly completely its light can be controlled by a reflector and the greater its efficiency. This is the reason for the high effectiveness of midget bulbs. A seven inch reflector that increases the amount of light from a midget bulb 15 times would probably increase the light from a larger bulb only 4 or 5 times. Indeed, in order to get a similarly efficient performance from the large bulb, it would be necessary to use a reflector something like 21 inches in diameter. The smaller the bulb, the smaller the reflector needs to be. If we had a flash bulb as small as a peppercorn, we could have highly efficient performance with a reflector an inch in diameter.

Another factor affecting efficiency is the screening action of the bulb itself. Most of the reflector surface immediately behind the bulb does not function because the bulb "gets in its own light." The larger the bulb, of course, the greater the loss from this cause.

It is necessary, therefore, that a bulb be fitted to a reflector of the right size and type. Use of a bigger bulb will not necessarily give you more light unless you employ the right kind of reflector for it.*

5 and 6. *Shutter speed and diaphragm opening.* In flash, shutter speed is a less accurate guide to exposure than is diaphragm opening. This fact is due to the peculiar pattern of the flash curve. (See Figure 2.) Synchronization is generally adjusted to get the best part of the light in a short exposure. An exposure of 1/200 takes in the highest part of the curve approaching the peak. Extending the exposure to 1/100 includes also the similar portion just beyond the peak. But an exposure of 1/50 takes in a considerable portion of the tail of the curve, where the light is failing rapidly. With an ordinary light source, an exposure of 1/50 is precisely four times as great as 1/200; but this is not the case with a flash bulb. With flash, an exposure of 1/50 is noticeably less than four times as effective as 1/200. This inconsistency is more apparent in bulbs with a high peak.

Results, therefore, are more directly comparable when F: settings are compared rather than shutter speeds. So it is the practice in flash photography to keep to a standard shutter speed in all cases possible, and to make exposure adjustments by means of the diaphragm alone.

7. *Reflecting surfaces surrounding your subject.* Standard exposure tables are based on the use of flash in an interior with what are rather vaguely designated as "normal," "medium," or "average colored" walls. Reflection, or the lack of it, from surrounding surfaces may substantially alter your exposure calculations. Nothing but a little experimentation will discover whether your own walls are hyper-normal, infra-medium or just ultra-average.

Very light walls may necessitate closing down about half a stop (from F:16 to F:18, for example), while dark walls may require opening up a similar amount (say from F:16 to F:12.7).

8. *Nature of subject matter.* The colour and texture of the subject matter itself may also upset your exposure calculations. Ex-

* It is not difficult to make a rough test of the efficiency of a reflector. Replace the flash bulb with an inside frosted incandescent of approximately the same size and shape. Plug it in the 110 volt current and place it so it shines on a wall. With a light meter take the reading from the wall; first, of the bare lamp; second, of the lamp with the reflector in question. Comparison of the two readings will reveal the effectiveness of the reflector.

posure tables, as in the preceding case of surrounding surfaces, are based on subject matter which is presumably "normal," "medium," and "average." Once more, common sense and possibly a little experimentation will be needed to determine whether your subject matter departs widely from the hypothetical norm of the exposure tables.

An unusually dark subject will require a slightly larger diaphragm opening (possibly one-half stop), while very light coloured material will demand closing down to a similar extent.

Calculating Exposure.

In the good old days of photography, determination of exposure used to be achieved by a combination of hard practical experience and a sort of mystical intuition. The photographer would momentarily retire into the silences of his soul and emerge with the message, "One twenty-fifth of a second at F:11"—which surprisingly often turned out to be right.

For the amateur, lacking both the practical experience and the private wire to the infinite, exposure was a source of much sorrow. For his benefit, there were compiled numerous exposure tables. These, however, were hedged about with so many variables in regard to subject matter, season of the year, state of the weather, time of day, etc., that the amateur was often more confused than benefited thereby.

To the amateur, as well as the professional, the photo-cell meter was an expensive but valuable assistance. Although far from infallible, the meter was able to supply hard, factual information about lighting conditions and quickly translate it into photographic practice.

Now we have a new lighting source—the flash bulb. Thus far, we are not able, except indirectly, to use the photocell meter in connection with it. So, in the matter of exposure, so far as flash bulbs are concerned, we find ourselves thrust back into the old exposure table period, or even farther back into the era of guesswork.

The saving element in the whole situation is the notable uniformity of performance of the modern flash bulb. Once you have

William Mortensen

Flash is unexcelled for animal portraiture. Note crisp rendering of fur and wide-open eyes.

determined how a given bulb will perform under given circumstances, you are reasonably certain of uniform results henceforward under those conditions.

Another sound rule for procedure is furnished by the inverse square law. If you know that a bulb produces a certain effect at (let us say) 10 feet, you know also that it will be four times as effective at 5 feet.

Finally, it should be noted that, because both values progress arithmetically to express a geometric change in light intensity, the *distance* of the flash from the subject and the *F: setting* of the lens constitute, for any given exposure, a constant product. This fact is the basis of the "flash number" system used in the following exposure tables.

We reprint herewith the manufacturers' official exposure recommendations for Wabash and General Electric flash bulbs. These tables are as nearly accurate as careful checking and experimentation can make them, but it must be remembered that they should be taken as guides, not as gospel.

Under some conditions, less cumbersome methods for determining exposure may be used. I shall refer to these in later chapters.

General Electric Exposure Data.

Table III

TUNGSTEN FILM SPEEDS

For Use in Determining Exposure with G-E Mazda Photoflash Lamps

Film characteristics are subject to constant improvement, for which new film speed ratings are required. Always inquire for the latest G-E or Weston ratings when using a film for the first time. Because the standards for correct exposure with color film are different than for black and white films, consult the manufacturer's data for recommendations.

The following are official film speed ratings published by agreement with the Weston Electrical Instrument Corporation and the Film Testing Laboratory of the General Electric Co.

W=Weston G-E=General Electric

ROLLS AND PACKS

	W	G-E
AGFA		
Superpan Press	64	100
Superpan Supreme	32	48
Finopan	16	24
Super Plenachrome	32	32
Plenachrome	16	24
Standard	8	12
EASTMAN		
Super XX	64	100
Panatomic X	16	24
Verichrome	32	24
N. C.	4	12

GEVAERT

Panchromosa	16	24
Express Superchrome	8	6

MINIATURE CAMERA FILMS

AGFA

	W	G-E
Ultra Speed Pan	64	100
Superpan Supreme	32	48
Finopan	16T	24
F. G. Rev. Superpan	16	18
F. G. Plenachrome	16	12
Minipan	5	4

DU PONT

Superior 1	16	24
Superior 2	32	48
Superior 3	64	100

EASTMAN

Super XX	64	100
Plus X	32	48
Panatomic X	16	24
Microfile	2.5	4

GEVAERT

Express Superchrome	16	6
Panchromosa	8	12
Panchromosa Micrograph	8	6

PERUTZ

Peromnia	8	12
Neo Perseno	4	1.5
Perpantic	8	6
Pergrano	4	3

PORTRAIT AND COMMERCIAL

AGFA

	W	G-E
Triple S. Pan	64	200
Superpan Press	....	200
Isopan	32	100
S. S. Panchromatic	32T	24
Superpan Portrait	32	24
S. S. Plenachrome	16	24
Commercial Pan	16	12
Portrait	8	12
Commercial Ortho	8	12
Commercial	4	6

DEFENDER

Arrow Pan	64	80
X. F. Panchromatic	32	64
X. F. Orthochromatic	16	24
Portrait H. G. S.	16	24
Pentagon	16	16
F. G. Panchromatic	16	12
Portrait	8	12
Commercial	4	6
Seed 27 Plate	8	12
Seed L. Ortho Plate	8	12
Seed 26 X Plate	8	12
Seed L. NH Plate	8	12
Stanley Reg. Plate	8	12
Stanley Ex. Imp. Plate	8	12
Standard Orthonon Plate	8	12
Seed 23 Plate	2	3

EASTMAN

Tri-X Panchromatic	64	200
Ortho-X	64	64
Super XX	32	64
Panatomic X	16	24
S. S. Ortho Portrait	16	32
S. S. Panchromatic	32	48
Portrait Pan	16	48
Commercial Pan	16	24
Par Speed Portrait	8	16
Commercial Ortho	8	12
Commercial	4	8
Polychrome Plate	8	12
W. & W. Tricolor Plate	32	48
50 Plate	16	16
40 Plate	8	12
D. C. Ortho Plate	8	12
S. C. Ortho Plate	8	12
33 Plate	4	6
Universal Plate	8	12
W. & W. Pan Plate	8	12
Post Card Plate	4	6
Commercial Plate	4	8
W. & W. M. Plate	8	12
W. & W. Metallographic Plate	4	6

GEVAERT

Studio High Speed	16	24
Superchrome	8	12
Ultra Panchro Studio	8	12
Ortho Commercial	8	12
Commercial	4	6
Ultra Panchro Plate	16	24
Sensima Ortho Plate	4	6
Super Chromosa Plate	4	6

HAMMER

Tru-Tone Pan	8	12
Portrait Ortho	4	6
Commercial Pan	8	12
Med. Comm. Ortho Slow	2	3
Slow Ortho	1	1.5
Med. Commercial	2	....
Slow	1	....
Special Plates	8	12
SS Ortho Plate	....	12
Commercial Pan Plate	4	6
Extra Fast Plate	4	6
Med. Commercial Ortho Plate	4	6
Med. Commercial Plate	2	3

Soft Gradation Pan Plate	8T	3
Slow Plate	1	1.5
Slow Ortho Plate	1	1.5

PRESS FILMS

AGFA

	W	G-E
Superpan Press	64	100
Super Plenachrome Press	32	48
DEFENDER		
X. F. Pan Press	32	48
X. F. Ortho Press	16	24
EASTMAN		
Super Panchro Press	64	100
Super Ortho Press	32	48
Panchro Press	32	48
Ortho Press Plate	16	24
Super Panchro Pr. Plate	64	100
GEVAERT		
Ultra Panchro A. H. Pr.	24	16
Super Pr. A. H. Plate	16	24
Super Ortho Press	....	9
HAMMER		
Super Ortho Press	4	6

COLOR FILMS

DEFENDER

Dupac	12	16
Tripac	3	5
DUFAYCOLOR (*With filter recommended by mfr.)		
Roll Film		
Photoflash*	3	5
Cut Film		
Tentative Ratings		
Daylight Type		
Photoflash*	3	....
Photoflood Type		
Photoflash*	4	....
EASTMAN KODACHROME		
Roll Film		
8, 16, 35 mm. Regular (Filter)	3	4
8, 16, 35 mm. Type A	12 'KA'	16
Professional Film		
Type B (Filter, except with 3200°K lamps)	6 'KB'	12

NOTE

Use these data as a guide rather than as a specific recommendation. A basic exposure of more or less than that indicated may give better pictures for individual equipment, method, subject matter and results desired.

BASIS

All exposure data is based on the use of G-E MAZDA Photoflash lamps in good metal reflectors—indoors in an average-sized room with medium-colored walls and ceilings—with lamp, camera and subject on axis. Outdoors at night, in large or dark-walled interiors, use one stop opening larger than the guide indicates or reduce the lamp-to-subject distance to three-quarters of that indicated.

Photoflash data for 1/25 to 1/1000 second apply to exposures made with a synchronizer. Data for "Time, Bulb" mean that the camera shutter is opened, kept open while the lamp is flashed, then closed. Data for lamps No. 6 and No. 31 is for focal-plane curtain shutters only.

TO FIND EXPOSURE

Find film speed rating in Table III.

Locate proper guide number for film speed, shutter speed, lamp and reflector, in tables.

FILM SPEED						
Weston		4	8	16	32	64
G-E		6	12	24	48	100
G-E MAZDA PHOTO-FLASH Lamp		(KB)	(KA)			
No. 21	Time, Bulb, 1/25, 1/50	110	155	220	310	440
	1/100	85	120	170	240	340
	1/200, 1/250	70	100	140	200	280
	1/400, 1/500	50	70	100	140	200
No. 50	Time, Bulb, 1/25	175	250	350	500	700
	1/50	150	210	300	420	600
No. 31	1/200, 1/250	44	60	88	120	175
	1/400, 1/500	30	44	60	88	120
	1/1000	22	30	44	60	88

↑ **The above tables for lamps No. 21, 50, 31 are based on the use of large studio reflectors especially designed for larger lamps.**

Table IV

FILM SPEED						
Weston . . .		4	8	16	32	64
G-E		6	12	24	48	100
G-E MAZDA PHOTO-FLASH Lamp		KB	KA			
No. 11	Time, Bulb, 1/25, 1/50	70	100	140	200	280
	1/100	55	78	110	155	220
	1/200, 1/250	44	60	88	120	175
	1/400, 1/500	30	44	60	88	120
No. 16A	Time, Bulb, 1/25, 1/50	80	113	160	225	320
	1/100	62	88	125	175	250
	1/200, 1/250	50	70	100	140	200
	1/400, 1/500	35	50	70	100	140
No. 21	Time, Bulb, 1/25, 1/50	85	120	170	240	340
	1/100	65	92	130	185	260
	1/200, 1/250	55	75	110	150	220
	1/400, 1/500	38	55	75	110	150
No. 50	Time, Bulb, 1/25	135	190	270	380	540
	1/50	115	160	230	320	460
No. 31	1/200, 1/250	33	48	66	96	130
	1/400, 1/500	24	33	48	66	96
	1/1000	17	24	33	48	66

This table is based on the use of average reflectors furnished with synchronizers.

Table V

FILM SPEED						
Weston . . .		4	8	16	32	64
G-E		6	12	24	48	100
G-E MAZDA PHOTO-FLASH Lamp		KB	KA			
SM	Time, Bulb, 1/25, 1/50, 1/100	30	42	60	84	120
	1/200, 1/250	24	34	48	68	96
	1/400, 1/500	19	27	38	54	76
No. 5	Time, Bulb, 1/25, 1/50	70	100	140	200	280
	1/100	55	78	110	155	220
	1/200, 1/250	44	60	88	120	175
	1/400, 1/500	30	44	60	88	120
No. 6	1/100	33	48	66	96	130
	1/200, 1/250	24	33	48	66	96
	1/400, 1/500	17	24	33	48	66
	1/1000	12	17	24	33	48

↑ **The above tables for SM, No. 5 and No. 6 lamps are based on the use of reflectors especially designed for midget lamps.**

Table VI

For example, the guide number for Photoflash lamp No. 11 with shutter set for "Time, Bulb, 1/25, 1/50" in an average reflector, with a film rated at 64 Weston or 100 G-E is 220. Divide the guide number by the distance in feet from lamp to subject to get the recommended F/number. At 10 feet, 220 divided by 10 gives 22, use F/22; at 20 feet, 220/20 = F/11, etc.

COLOR PHOTOGRAPHY

Success in color photography depends largely upon accuracy of exposure. Exposure guide numbers giving best average results will be found in the tables under the mark 'KA' for Kodachrome "Type A"—'KB' for Kodachrome "Type B." In all color processes, an increase or decrease in the basic exposure recommended may give better results. With Kodachrome transparencies, for example, more exposure gives a lighter result, less exposure a darker result. (See procedure for working out individual guide numbers under "To Find Exposure")

Care should be used to expose color film to the type of light for which it is balanced or to use the proper filter. Printed instructions will be found in the film package.

G-E MAZDA Photoflash lamps No. 21B have a blue filter coating especially balanced to give correct color rendition with "regular" Kodachrome. They are intended for use with a synchronizer, to illuminate near shadows and dark foregrounds when the rest of the scene is in daylight.

They may be used as the sole source of illumination with "daylight" color films. Other combinations of regular photoflash lamps with the proper color film may be more desirable insofar as lamp cost and exposure is concerned—for pictures where artificial light and daylight are not mixed.

GUIDE NUMBERS FOR G-E MAZDA PHOTOFLASH LAMPS No. 21B
(In average reflector furnished with synchronizers)

		Regular Daylight Kodachrome	
No. 21B		Roll Film	Professional Film
One Lamp	Time, Bulb 1/25, 1/50	40	35
	1/100	31	27
	1/200, 1/250	20	17
Two Lamps	Time, Bulb 1/25, 1/50	56	45
	1/100	45	35
	1/200, 1/250	28	22

Table VII

Wabash Exposure Data.

A simplified method to determine correct exposure data has been adopted for use with Wabash Superflash Photolamps. This new method known as the "Flash Number" method is much easier to use, for all you have to remember is your Flash Number at the speed you regularly use to get your f stop at any distance. Simply do these three things:

1. Check your film against Table VIII to find A, B or C film speed.
2. Refer to Table IX on Superflash size to get your Flash Number at shutter speed you use.
3. Divide the Flash Number by the distance in feet from lamp to subject to get the f stop.

Example: Supposing you use Agfa Superpan Supreme or Eastman Plus X with Superflash Press 40 and want to shoot at 1/100th of a second at a subject 10 feet away. Checking the film list, Table VIII, you find these films are B films. Checking the Press 40 table at 1/100th of a second you find your Flash Number is 160. Dividing 160 by 10 (distance in feet) your lens opening is f/16.

Table VIII

FILM A, *Weston Tungsten Rating 64*

Agfa Superpan Press
Agfa Triple "S" Pan
Agfa Ultra Speed Panchromatic
Defender Arrow Pan Press
DuPont Superior 3
Eastman Ortho X
Eastman Super Panchro Press
Eastman Super XX Pan (roll, pack & 35 mm.)
Eastman Tri X Panchromatic

FILM B, *Weston Tungsten Rating 32*

Agfa Isopan
Agfa Superpan Portrait
Agfa Superpan Supreme
Agfa Super Plenachrome
Agfa Super Plenachrome Press
Agfa Supersensitive Panchromatic
Defender XF Panchromatic
DuPont Superior 2
Eastman Panchro Press
Eastman Plus X Pan
Eastman Super Ortho Press
Eastman Supersensitive Panchromatic
Eastman Super XX Pan (cut film only)
Eastman Verichrome
Gevaert Panchromosa
Gevaert Ultra Panchro Press

FILM C, *Weston Tungsten Rating 16*

Agfa Commercial Panchromatic
Agfa Fine Grain Plenachrome
Agfa Finopan
Agfa Plenachrome
Agfa Superpan Reversible
Agfa Supersensitive Plenachrome
Defender Fine Grain Pan
Defender Pentagon
Defender Portrait H.G.S.
Defender XF Orthochromatic
Defender XF Ortho Press
DuPont Superior 1
Eastman Commercial Pan
Eastman Panatomic (Bantam)
Eastman Panatomic X
Eastman Portrait Panatomic
Eastman Super Speed Ortho Port. AH
Gevaert Express Superchrome
Gevaert Super Ortho Press
Gevaert Ultra Panchro Studio

Table IX

Superflash Bulb Size	Film Speed	1/50 Sec. Flash No.	1/100 Sec. Flash No.	1/200 Sec. Flash No.
No. 0 or Press 25 in regular type reflector	Film A	#200	#140	#100
	Film B	#140	#100	# 65
	Film C	#100	# 65	
Press 40 or Press 25 in directed-flash reflector	Film A	#340	#230	#160
	Film B	#230	#160	#110
	Film C	#160	#110	# 80
Press 50	Film A	#380	#270	#190
	Film B	#270	#190	#130
	Film C	#190	#130	# 95
No. 2	Film A	#450	#320	#230
	Film B	#320	#230	#160
	Film C	#230	#160	#120
No. 3X	Film A	#500	#360	#260
	Film B	#360	#260	#180
	Film C	#260	#180	#130
No. 3	Film A	#560	#400	#280
	Film B	#400	#280	#200
	Film C	#280	#200	#140

The exposure data in Table IX is calculated for indoor use in rooms with medium colored walls. For outdoor use in total darkness, use the next larger lens opening.

FOCAL PLANE FLASH USE

Miniature cameras with the focal plane type of shutter require a flash bulb with a longer duration of "peak light," to allow ample time for the focal plane shutter to slide across the film while the light is at its peak.

Focal plane shutters which travel from top to bottom as on the Contax and Contaflex types, can be used successfully with the Press 40, Press 50, No. 2 and No. 2A sizes.

Focal plane shutters which travel across the film from left to right, as on the Leica, Perfex and Exakta types, require slightly longer duration as their focal plane slot travels farther and takes somewhat longer to cover the entire film. Superflash No. 2A is the size recommended for this purpose, although the Press 50 and No. 2 will also provide satisfactory results. The following table is computed for 1/200th of a second speed:

Table X

Superflash Size	Film Speed	Flash No.
	Film A	#120
Press 40	Film B	# 80
	Film C	# 65
	Film A	#130
Press 50	Film B	#100
	Film C	# 65
	Film A	#160
No. 2	Film B	#110
	Film C	# 80
	Film A	#100
No. 2A	Film B	# 65
	Film C	# 40

SPEED GRAPHIC—$2\frac{1}{4}$x$3\frac{1}{4}$″

When using the focal plane shutter of the miniature $2\frac{1}{4}$x$3\frac{1}{4}$″ Speed Graphic, the No. 2 Superflash size is recommended. The following exposure table is computed for use of this size with high speed films in the "A" rating:

Table XI

Superflash No. 2	1/100 sec.	1/305 sec.	1/700 sec.
10 ft.	f/14	f/9.5	f/6.3
15 ft.	f/9.5	f/8	f/5.6
20 ft.	f/8	f/6.3	f/4.5

SPEED GRAPHIC—Up to 4x5″

The larger focal plane cameras such as the Speed Graphic and Graflex cameras in the $3\frac{1}{4}$x$4\frac{1}{4}$″ or 4x5″ sizes, require a flash bulb with an extra long "peak light" duration when the focal plane back shutters are used. The No. 2A Superflash size is designed with an extra long "plateau-peak light" flash especially for use with these larger focal plane shutters. The following table is computed for use of the No. 2A Superflash with either the $3\frac{1}{4}$x$4\frac{1}{4}$″ or the 4x5″ size:

Table XII

Superflash No. 2A		1/1000 sec.	1/860 sec.	1/680 sec.
	Film A	f/12.5	f/16	f/16
10 ft.	Film B	f/9.5	f/9.5	f/11
	Film C	f/6.3	f/6.3	f/6.3
	Film A	f/8	f/9.5	f/9.5
15 ft.	Film B	f/5.6	f/5.6	f/6.3
	Film C	f/4.5	f/4.5	f/4.5
	Film A	f/5.6	f/6.3	f/6.3
20 ft.	Film B	f/4.5	f/4.5	f/5
	Film C	f/3.5	f/3.5	f/3.5

Part Two

Chapter One

Sentimental Record

Probably the most sentimentally appealing and photographically appalling thing in this world is an album of old snapshots. In these records of past years, slightly dog-eared and hypo-stained, blurry, out-of-focus and over-exposed, pictorially negligible and technically terrible, we find the very essence of the things that we like to remember about those years.

The snap shot and its frank, unblushing faults have always been considered fair game for wisecracks. But we can't get along without it. Even the most callous of wisecrackers have a few adored atrocities pasted in albums or tucked away in pigeon-holes.

In one form or another, the unpretentious and homely snapshot will always persist, (Figure 14) for it fills a great human need. Nothing in this world abides, as poets and philosophers have often noted, all things change, and the winds of time whistle past our ears as we speed upon our way. By means of the snapshot, however, we are afforded an opportunity for salvaging a few grains of this near and dear present before it slips from our grasp.

They are mostly humble and familiar things that find their way into snapshots: Junior (aged six months) in his bath, Junior (aged

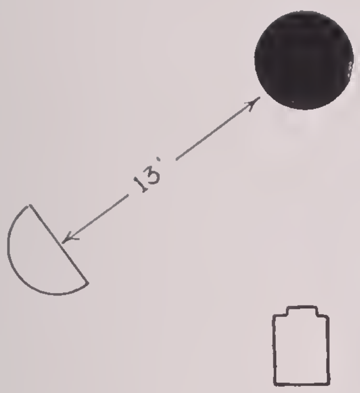

Figure 14.

A press picture, but one typifying the best qualities of the snapshot — honesty, humor and a homely sense of the dramatic.

Data: 4x5 Speed Graphic, 1/200 second at F:22. One Wabash Press-40 slightly to left of camera.

"Hello Santa" *Henry McAllister, N. Y. Journal-American*

eighteen months) struggling with his oatmeal, Junior (a few years later) on his tricycle, Junior starting to school, Junior graduates from high school, Junior brings home friends from college, Junior and Mrs. Junior on their first anniversary. Junior himself now takes up the tale, *da capo*, with a faithful chronicle of Junior II, interspersed with records of Sunday visits with Grandma and trips to the beach.

The faults of these pictures are just about as familiar and standardized as their subject matter. Let me ennumerate a few of the more outstanding of these. (I leave out of consideration such elementary errors as double exposures and tilted skylines, which are simply carelessness or extreme ineptness.)

1. Movement. (Junior is restless and moves too suddenly for the camera to stop his action.)

2. Contrasty illumination. (The ancient superstition of the snapshot which insisted on putting Junior in the brightest sunlight possible. The resulting pictures were all dense shadow and intense illumination, with no half-tones in between.
3. Over-exposure. (Light-areas in Junior's face bleak, white without gradation. The almost inevitable running mate of contrasty illumination. This condition was encouraged by the recommendations offered by the film manufacturers, who surmised that the amateur was more interested in getting an image every time than he was in securing photographic quality.)
4. Under-exposure. (Resulting from efforts to shoot Junior indoors or in a subdued light. The negative is thin and gutless; the print, gray, murky and depressing.)
5. Lack of depth of field. (The usual habit of shooting with the lens wide open, or nearly so, in order to get as much speed as possible, leads to backgrounds that are badly fuzzed and out of focus. Or, if Junior is being shot from close up, it may present him with his nose sharp and his ears fuzzy.)
6. Bad expression. (Junior looks into the sun and squints. Or he gets self-conscious at all the preparations and puts on a silly expression. Or he gets tired of being pushed around by a camera and simply sulks.)
7. Bad backgrounds. (Preoccupation with getting the subject in good light leads to disregard of background and to consequent confused or irrelevant backgrounds.) So the sentimentally precious record is often presented in a setting of ash cans or of those illuminated blobs that we have elsewhere designated as "gall stones."*

Now, these intimate record shots that mean so much to us for personal and sentimental reasons are deserving of far better photographic treatment than they usually receive. In the book *Outdoor Portraiture* I have made a few simple suggestions for improving

* See Outdoor Portraiture, page 97.

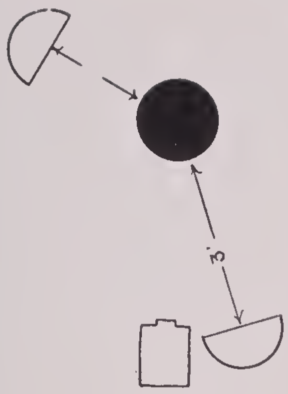

Figure 15.

"Doggone, What a Life"

Truman B. Gordon

First Prize Winner in Kalart Annual Speed Flash Contest—1940.

Puppies frequently become subjects of sentimental record, but seldom are they so charmingly rendered as in this well-known flash picture.

Data: Super Ikonta B with Kalart synchronizer, 1/100 second at F:16 on Panatomic X. Two Wabash Press-40's placed as shown in diagram.

the quality of informal record pictures. Among these suggestions were the following:

1. *Use fast films.* Modern fast emulsions are better able to stop action and to secure more spontaneous expression. Under ordinary light conditions it is possible with these films to use smaller apertures and secure greater depth of field. Speedier emulsions also make feasible record shots with subdued light.
2. *Give thought to backgrounds.* Whenever possible, get your subject against a plain wall or fence, thus avoiding the customary out-of-focus confusion. A high or low camera angle helps in eliminating undesirable backgrounds.
3. *Protect your exposure.* Whenever possible, take several exposures of the same set-up, shooting both above and below the presumed "correct" exposure. At first sight, this may appear an expensive proceeding, but it actually

pays off in the long run with a higher percentage of really good exposures.

4. *Shoot only when the light is good.* Avoid the midday hours for outdoor photography. The light is much better when the sun is low. Take advantage of times when the sun is veiled in light clouds or fog.
5. *Take advantage of reflecting surfaces.* Contrasty illuminations are relieved by reflected light thrown into the shadow areas. In making record shots, it is seldom possible or desirable to set up a reflector, but natural reflecting surfaces are often available: a stretch of sand or water, a concrete walk, a stuccoed wall, or the side of a house.

These points are all sound advice, and decent observance of them is certain to improve the photographic average of those pictures that you take, not to try out new gadgets, or in the hope of crashing the salon, but simply because the subject matter itself is of sentimental concern to you. But there are still some situations that these bits of wisdom fail to meet. The episodes that you want to perpetuate don't always take place when the light is of good quality, or where the backgrounds are beyond cavil, or where there are reflecting surfaces to take advantage of. Indeed, many of the most intimately precious moments seem to be stubbornly opposed to everything that makes good photographic quality.

For these situations the flash bulb is a great help to the amateur. Many problems that were extremely difficult photographically are rendered relatively simple by its use. (Figure 16.)

It is in the making of sentimental record shots that the problems of photography first cross the path of the average citizen. Practically all photographers, amateur or professional, have cut their photographic teeth in the making of "snapshots." So it seems logical that in this humble and familiar field we should first consider the practical problems of flash photography. The basic principles involved are the same, no matter whether you are taking a picture of Junior in his bath or of the "B-19."*

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* It is quite significant, I think, that the best baby pictures in this book are by Lawrence Kronquist, the same man who took the magnificent pictures of the B-19.

"Box Supper" *Marion Post-Walcott (F.S.A.)*

Figure 16. This F.S.A. shot from Breathitt County, Kentucky, typifies the genuine spontaneity made possible in record pictures by the use of the flash.

Basic Equipment.

The equipment used for these purposes should be as simple as possible. Conditions commonly afford no opportunity for rigging long extensions or for calculating multiple-flash exposures. Nor are these more complicated set-ups the best way to learn about flash. It must be remembered that we are considering this application of flash to domestic photography in the light of what it usually is: an elementary course in flash photography.

This, then, is the equipment that we assume for most of the work considered in this chapter:

1. Camera, of course. If you intend to limit yourself at first to the "open and shut" type of flash, any sort of camera will serve. But it is better to have one with a lens capable of closing down to F:22, and with a shutter speed at least as high as 1/200. Any size, from miniature on up.

2. A synchronizer, either mechanical or electric. It is better that it be able to deal with speeds as high as 1/200. It should be a sound piece of machinery and proved to be "in sink" before you start. Nothing is a more futile piece of apparatus than a synchronizer "out of sink." It is preferable that the synchronizer be so rigged that the lamp can be unhooked and held at arms length from the camera. It should be able to handle both miniature and standard-base lamps.
3. Two reflectors, one of the regular type and the other of the special type designed for the miniature bulbs.

Things to Remember.

Most articles and books on flash (and this one is no exception) give the impression that one has to be a walking exposure table and a peripatetic lexicon of curious scientific lore in order to take a good flash picture. A little knowledge of what you are doing does no harm, of course, but the things that one needs to bear in mind at first can be boiled down into a fairly compact compass.

1. Use the smallest bulb possible for a given job. Small bulbs cost less and give better results. A harsh glare of light is a sign of bad photography and too big a bulb. Use the efficient midget bulb whenever possible. For close up work, use a flat reflector, rather than the hot, "rifle beam" type. Resort freely to diffusion to take the edge off your light. (I will have more to say about diffusion a little later.)
2. Bear in mind the limitations imposed by the law of "inverse squares." This is a very hard-boiled law: it states that at twice the distance from the light source you get only one quarter as much light, and at four times the distance, you get only one sixteenth as much light, and there is nothing you can do about it. This means that working at close range, you must be exact in your distances. Measure them with a tape line, don't guess. If you guess that your lamp is six feet from your subject, and it turns out to be five, you will probably over-expose;

"Dirty Dishes" *Lee (F.S.A.)*

Figure 17. Even such a humble bit of domestic still life as this may lend itself to sentimental record. This picture looks like the aftermath of Figure 16, but these dishes got dirty in Oklahoma.

for at five feet you get nearly fifty-per-cent more light than you do at six.

3. Camera adjustments for flash are made largely by alterations of the F: setting—opening up or closing down the diaphragm. In ordinary photographic practice, it is customary to work from a safe base F: setting, altering the exposure to conform to different light conditions. But under the special circumstances of flash photography, it is found more convenient to work from a base exposure and to meet light changes by alteration of the diaphragm setting.
4. F: number and lamp distance vary inversely. For a given size of lamp and a given exposure, the distance and the F: number form a constant product. This convenient fact is the basis of the "flash numbers" in the Wabash and

G. E. exposure tables in Part I. The application of the "flash numbers" is very simple. If, for a given bulb and exposure, the flash number is 180, you would set the diaphragm at F:10 for 18 feet, at F:18 for 10 feet, and at F:30 for 6 feet. Simply divide the flash number by the lamp distance and the result is the proper F: setting.

5. When in doubt, don't guess. Figure it out from the exposure tables. Luck plays a much larger part in photography than is generally recognized, but it can't be depended on to help the dubious amateur about to pop his first flash bulb.

Uses of Diffusion and Reflection.

The light from the flash bulb is stark and abrupt. For certain types of subject matter requiring extreme crispness and mechanical harshness of rendering, it is an appropriate type of light. But this crispness and mechanical quality is utterly at odds to everything that we want in a sentimental record. A sleeping child, for example, should not be presented in the same cold, impersonal illumination in which we might appropriately display a helical gear. For domestic record, we want a light that is soft and intimate, that caresses the subject rather than blasts it with illumination. (See Figure 18.)

Fortunately, we have always available two means of controlling this sometimes undesirable quality of the flash. These two methods are *diffusion* and *reflection.*

Diffusion occurs when the straight beams proceeding from the flash and reflector are crossed up by passing through some translucent medium. The final effect of diffusion is the same as that of a reduced illumination proceeding from a much broader source. As a result, shadows in the subject have soft edges, instead of the razor-sharp, mechanical definition of shadows rendered by the undiffused bulb.

Many different materials can be made to serve as diffusion mediums. Two convenient mediums, both readily available, are a piece of architect's tracing paper or a thin silk handkerchief. Either of these may easily be clipped over the flash reflector with a rubber band.

"Diana in the Bath"

Lawrence Kronquist
(Special photographer for Douglas Aircraft Co.)

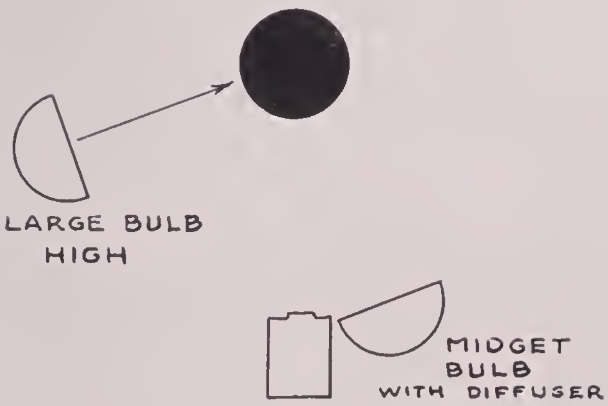


Figure 18. A heavy percentage of the output of household photographers is justifiably given over to baby pictures. Seldom, however, do they remotely approach the quality of this one. Concerning it, Mr. Kronquist gives the following data: "A 40,000 press bulb in a high stand reflector (large diffusing type) a peanut bulb on the camera (#5) diffused with oiled silk bowl cover to soften its spot effect. Exposure 1/100 second, stopped way down. A long lens shade helps in cutting down the kick back from the tile walls. Negatives developed by inspection."

Diffusion, of course, reduces the volume of light materially. Either of the mediums mentioned above — tracing paper or silk handkerchief—would cut the light about in half.* In order to compensate for this reduction in light, it would be necessary to open up the lens by *one stop.* For example, if the indicated exposure and "flash number" called for an aperture of F:16, it would be necessary, if the bulb was diffused with tracing paper, to open up to F:11.

Reflection is the other means of reducing the inherent harshness of the flash illumination. Both in *Pictorial Lighting* and *Outdoor Portraiture* I have mentioned the need of some sort of reflector to cope with a contrasty and/or unbalanced light. The reflector serves to moderate the unbalance by directing some soft illumination into the shadowy side of the subject.

It is not usually convenient to use a flat white reflector of studio type in the sort of photography that we now have under consideration. However, there are almost always other surfaces that can be made to serve the same purpose. The commonest of these extempore reflectors is a white or light-colored wall. If the subject is seated at table, a white table cloth will help to reduce lighting contrast. Even an open book is useful along these lines.

Note in Figure 19 how the subject is arranged to take advantage of the reflection from light colored surroundings.

In circumstances where a wall is not available, a good make-shift reflector can be made by a sheet or large white towel hung over the back of a chair just out of the camera range.

If there is a large amount of reflection from the walls, it may be necessary to reduce the lens aperture a bit. The exposure tables are based on an interior with what are rather vaguely designated as "average colored walls." So, if the room in which you are working has extremely light walls, allow for the fact by closing down your diaphragm by one half stop (for example, from F:16 to F:18). However, if you are using diffusion at the same time, there will be an approximate stand-off between the two effects, and you will let the diaphragm setting stand as it is.

Two Types of Lighting.

There are two sorts of lighting that may be sought for in the

* For more about the effect of various diffusing mediums, see Chapter Two, page 84.

Figure 19. Surrounding reflective surfaces heighten effect of flash.

sentimentally conditioned branch of photography. Both are perfectly logical procedures, but they represent somewhat different aims.

One type of lighting is illumination pure and simple. It exists simply to exhibit the subject to the best possible advantage. In the best examples of this type of lighting you are really not aware at all of the light as such, but only of a very satisfactory presentation of the subject. An excellent example of lighting conceived in this particular spirit is that in Figure 33.

This is fundamentally the same as the Basic Light, "lighting for the sake of visibility."* The situation is much the same, a single front lighting unit, at or near the camera, a minimum of cast shadow. Since the image itself, for its own sake, and not the lighting "effect," is usually the thing with which the amateur is concerned, this procedure is the logical one for the greater part of sentimental record shots.

The other type of lighting usually involves a bit of simple stagecraft. An effort is made with this sort of light to introduce or imply some natural source of illumination—a lamp, a fireplace, or a window. (Note Figure 132.) This treatment is useful when one wishes to present, not only the subject, but a hint of the atmosphere of the *setting* in which the subject belongs.

Lighting of this sort is almost always unbalanced and involves the operation of the flash through an extension, either held in the hand or, in some cases, actually installed in the fireplace or lamp that is the supposed source of the illumination. In such cases, it is desirable to plan the set-up so as to take advantage of available reflecting surfaces to fill in the shadow areas. Otherwise, your lighting will be mechanically harsh and contrasty, lacking any of the essential intimate atmosphere. It should be noted that such "lamplight" or "firelight" pictures may most advantageously be taken in the daytime, with the natural light of the room serving as "fill in" for the flash shadows.

The "Flash Effect."

As a technical adjunct to photography, flash must serve as a "silent partner," always useful and always subordinate. When the

* Pictorial Lighting, Chapter Three.

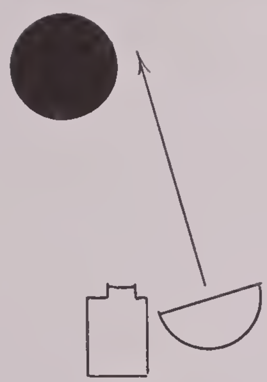
Figure 20. Correct arrangement of elements minimizes shadow and takes advantage of reflecting wall surfaces.

flash betrays its presence in a blatant or obvious fashion, it has been wrongly used. Obvious symptoms of the flash are just as much out of place and just as detrimental to the picture as would be the inclusion of lamp standards and trailing cables in a studio portrait.

Here are some of the obvious symptoms of flash photography. Take pains to avoid them.

1. *Too much light.* Nothing so immediately betrays the inept use of flash as a blasting glare of light. Various remedies will help cure this defect; use smaller bulbs, put your light further away, diffuse your light.
2. *Shadows on background.* When subject is close to background and background is at right angles to axis of camera, there are bound to be unpleasant and sharp silhouette shadows. Remedies: keep subject away from background, take background at an oblique angle.* (Note set-up in

* Background shadows may also be killed by an independent unit lighting the background only. This procedure involves an additional extension and is discussed in the following chapter.



"Mr. Fields Looks Over the International Situation"
by Roman Freulich, Universal Pictures.

Figure 21. An amusing publicity "gag" picture, but marred by conspicuous reflection of flash bulb in window.

Figure 20, which keeps obvious shadows off the wall and at the same time secures advantageous reflection from it.)

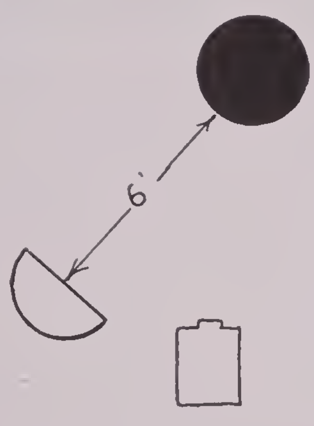
3. *Halations.* Unless you check beforehand, you may encounter mirror-like reflections from such things as glass doors or highly polished furniture. This effect, of course, very directly betrays the flash by reflecting its image right back into the camera. (For an example, see Figure 21.)
4. *Smacks and smears of light.* This term is employed to describe such effects as those shown in Figure 22. Here the light, instead of being used for illumination, is smeared,

Figure 22.

An unfortunately familiar flash effect. Smacks and smears of light resulting from flash bulbs too close, too concentrated, and in the wrong places.

like a luminous salve, on some few small (and usually unimportant) areas. The fundamental error in this case is a too concentrated source placed too close to the subject. Remedy: diffuse the light and move it further back.

5. *Illogic.* A good many flash pictures betray themselves through mere lack of logic and common sense. Too often there is no apparent reason for the fanciful aberrations of the illumination. Indeed, the lighting is sometimes directly opposed to the logical demands of the situation, with the stronger illumination on the side opposite the the ostensible source. A problem in logic must be handled, for example, in shooting a figure in semi-silhouette against a window. This is a situation that is very difficult to cope with by conventional photographic means, owing to the extreme range of luminosities involved: either the detail on the near side of the figure is lost in the shadow,



"Barnswallow Quintet" *Dr. and Mrs. Heathcote Kimball*

Figure 23. Prize Winner in Graflex Golden Anniversary Contest.

Data: 4x5 Speed Graphic, 1/200 at F:16, on Agfa Isopan. One Wabash 40 as sole illuminant.

or else the window is completely blanked out by overexposure. The flash offers a way out of this technical dilemma. But logic dictates that the flash should be very weak in this case—just enough to lift out of the shadow about the same amount of detail that the eye sees there. (Figure 97.) To set the fully illuminated figure against the window is offensive both to logic and good picture-making.

The Service of Flash to the Amateur.

In this last example lies the clue to the outstanding service of flash to the amateur: for the first time he is able to get into his picture that which his eye sees in the subject.

We may rage at or condescend to the bungling amateur as we will; but the fact is that the fault is not wholly his. He may be photographically inexperienced, but at least he is not utterly devoid of manifestations of human intelligence. At least he knows what his eye sees. And if the camera isn't able to deliver what his eye has seen, it rather is the fault of the camera for being a less clever and accomodating instrument than the eye.

This failure of photography to deal simultaneously with bright illumination and deep shadow on the same terms that the eye does is no doubt the principal cause of amateur photographic bungles. The flash meets this situation by evening up the range of luminosities and bringing it within the limits that the camera can handle.

So, although the use of flash raises the cost per exposure, the amateur will probably save money in the long run, for he can be much more certain of his results.

Chapter Two

Portraiture with Flash

Portraiture was one of the first problems to which the infant medium of photography applied itself. In 1839, according to the account, Dr. Draper posed his sister for twenty minutes under the noon-day sun and made the first photographic portrait. Unbelievable evolution and technical improvement has taken place since that day, but portraiture still remains one of the most important phases of photography. Not all the photographers are taking pictures of the B-19, or of John Powers models in Schaperelli gowns, or of the aftermath of battle, murder and sudden death. No, a large proportion of them are still in their studios up and down the land, turning out *portraits* of people and their babies. And the basic problems of the portrait maker are pretty much the same, no matter whether he is grinding out "Cabinet Size Photos" in a small town, or creating Personality Impressions at a hundred dollars a shot in a Fifth Avenue salon.

Portraiture is a large subject, and I have no intention of attempting a complete survey. All that we are concerned with at the moment is to look at some of the applications of flash to portrait problems.

From the beginning, one of the difficult problems of portraiture has been that of lighting—of getting the right amount of the right kind of light on the right places of the subject. Dr. Draper, in 1839,

Figure 24.

found difficulty in getting enough of any kind of light; so he put his subject in direct sunlight for a twenty minute exposure. Later, we were able to give attention to the *quality* of light, and we had our studios lighted by soft daylight, filtered and diffused through northern skylights. Then artificial lighting came in, bringing added pungency. This was a rather delirious period, marked by a burgeoning multiplicity of lighting units of all imaginable sizes, shapes and functions. Now we have the flash on our hands, potentially a valuable tool, but not an easy one to handle, and readily capable of fantastic abuses.

Flash in Portraiture.

The application of flash to portrait procedure resolves itself into two departments:

1. Technical problems.
2. Lighting problems.

The latter department is far more important and fundamental. Flash, if it is to merit mature consideration, must justify itself as a *lighting medium.* Technical details are important only if they contribute to this end. There is no merit in calculating the exposure for, and synchronously firing, two, twenty, or two hundred flash bulbs, unless you can produce thereby a better picture than you could with one flash bulb, or with no flash bulbs at all.

So let it be clearly understood at the beginning that we are interested in flash in portraiture, not as a means of amusing the amateur, or amazing his friends, but solely as a means of photographic lighting.

Functions of Light in Portraiture.

Conventional lighting practice suggests the need of three kinds of light on a subject:

1. Illumination.
2. "Fill-in" to soften or reduce shadows.
3. "Accent" to put in an emphatic high-light.

This is the basis of much contemporary portrait lighting, and it involves such complex set-ups as Figure 24. This whole procedure is based on a faulty notion of negative quality and represents an attempt to produce a good negative by main force rather than by a good exposure.

Under many circumstances, a *single* light source for the subject is all that is required. (Figures 25 and 26.) With correct exposure, a single front light, for "illumination" only, will produce excellent portraits. Such an arrangement is the principle of the so-called "basic light."*

With a less balanced lighting, there is need for a secondary source of illumination to fill in the shadow areas. I have advocated the use of a reflector for this purpose, placed on the shadow side of the subject.**

But the use of a secondary light source (much weaker or further away than the principal source) is entirely justifiable, and may prove more convenient under some conditions.

However, there is never any shadow of excuse, in normal portraiture, for the use of the "accent light" (or "boom light," or ""pep

* Pistorial Lighting, Chapter Three.
** Pictorial Lighting, page 55.

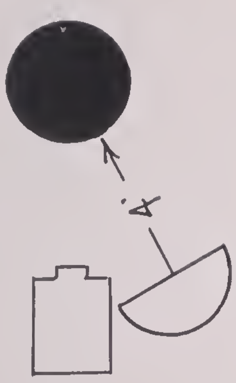


Figure 25. Rightly used, a light from a single source provides all the "accent" you need. Illumination by one small flash bulb, diffused.

light," or "wham light," or whatever you want to call it). Correctly exposed and lighted, a face will furnish its own proper accent high-lights without recourse to such devices. A "boom light" is simply an effort to violently blast high-lights into a negative in which the legitimate high-lights have all been destroyed by over-exposure.

There is a fourth weird use to which light on the subject is sometimes put. This use has even less justification than the "accent light."

4. The "back light," to relieve the head from the background.

A fairly typical example of this practice is shown in Figure 27. This sort of lighting inspires any reasonably-minded person with the desire to walk around behind where the light is better and see what the subject really looks like. Such an effect goes against all common-sense procedure, which dictates that the most light should be put where the most interest lies. Figure 27 alleges, in effect, that there is nothing worthy of note in the subject except her left ear, a tuft of hair, and a bit of her cheek-bone.

Why Lighting Anyway?

The lighting procedure outlined in this chapter is based in general on the thesis laid down in *Pictorial Lighting**: that lighting in portraiture should serve only to *reveal the subject*, not to exhibit the cleverness of the photographer or the wonders of his lighting equipment. Lighting "effects" are important in landscape, but have no part in portraiture. The best lighted portraits are those in which we are least aware of any "lighting" as such.

Therefore, attention will be concentrated in this chapter on those flash set-ups that most closely approximate the Basic Light and its immediate derivatives, the Modified Basic, the Contour, and the Semi-Silhouette Lights.* No mention is made of the Plastic or Dynamic types, since these are rarely adapted to portrait use. These latter are primarily pictorial in their application, and while they may be duplicated in flash set-ups, it is more reasonable and con-

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* Pictorial Lighting by William Mortensen. Camera Craft, 1935. $2.00.

"Fascination" *Ellsworth E. Zahn*

Figure 26. Prize winner in Graflex Golden Anniversary Contest. A fine example of portraiture with a single flash.

venient to use conventional lighting equipment for outright pictorial work in the studio.

Why Flash for Portraiture?

The skeptical reader may well at this point (if not sooner) raise the question of why one should use flash with portraiture when conventional lighting equipment is perfectly capable of doing the job, and at rather less expense per exposure. This is a thoroughly justified question, and one that should be answered before going further.

The answer to the question will be more readily appreciated if we consider it in the light of some of the notorious short-comings of studio portraiture.

Standard Faults of Studio Portraiture.

All of us who have ever patronized a portrait photographer, no matter whether we went for the Cabinet Size or the De Luxe job, have probably become aware of certain standard shortcomings in his work. The errors are actually almost as common in high priced work as in the cheaper variety; but we are not so apt to notice them, for the simple reason that we are far more prone to criticize something for which we paid $2.50 than something that cost us a hundred dollars.

And if we have happened to be the photographer instead of his victim, we have also been very much aware of these faults, although, for reasons of professional policy, we haven't called attention to them.

Under average operating conditions, studio portraiture is fairly sure to betray at least some of the undesirable characteristics listed herewith. (Figures 28 and 29 are reasonable facsimiles of portraits embodying these faults.)

1. Lack of depth of field. (Nose in focus, ears out of focus; or *vice versa.*)
2. Lack of normal expression. (The sense of being under a spotlight is bound to make an unaccustomed sitter self-conscious. Cumbersome equipment and too much fussing with it increases his apprehension. All these emotional

Figure 27. "Backlighting" consists of putting the most light in the worst places.

Figure 28. Faults of conventional studio portraiture—the squint.

states are sure to be reflected in his expression, no matter how "pleasant" he tries to look.)

3. Discomfort from heat and glare. (By actual test, the heat under the conventional lighting equipment may go as high as 100°F. or 110°F. This excessive heat not only damages make-up, but the sitter's temper and morale as well. The brightness of the lights so close at hand frequently leads to squints, incipient or overt. (Figure 28.) Even if no squint is apparent, the eye protects itself by closing down the iris to a mere pin-point, giving a hard, pinched expression to the eye.)
4. Movement. (Particular difficulty is encountered in dealing with wriggly subjects—small children and pets. (See Figure 29.) Usually no amount of cajoling with the traditional birdie will make them hold still, so the photographer desperately attempts to catch them on the fly, with much waste of film and energy. And sometimes an animal subject will flatly refuse to face the light.)

Here are four portrait faults, readily recognized as typical. No

Figure 29.

Faults of conventional studio portraiture —movement due to prolonged exposure.

doubt we could dig out a few more if we tried, but these are ample to illustrate our point.

Note that all these faults, typical of studio portraiture, are readily traceable to lighting. Lack of depth of field is due to lack of speed induced by lack of light, which the photographer tries to compensate for by opening up the diaphragm. And if he tries to gain speed by increasing the brightness or number of his lights, or by moving them closer in, he immediately evokes a variety of pained and tortured expressions. And if, on the other hand, he decides to sacrifice speed to depth of field by closing down his diaphragm and increasing his exposure, he thereby runs the hazard of getting movement in his picture. The whole set-up is a vicious circle, with the photographer trapped inside of it.

If he tries to side-step the problem by shifting to super-speed film, he again runs into difficulty, for high-speed emulsions are incapable of yielding the delicate half-tone quality that is required in good portraiture. Indeed, compared with the loss in quality, the gain in speed is negligible.

Flash to the Rescue.

In this situation, flash may be of genuine help. Nearly all of

Figure 30. Kittens are unperturbed when flash goes off.

the faults listed above are automatically eliminated by the fact that the flash provides a volume of light that, with a normal studio set-up, makes it possible to shoot a portrait in 1/200 second at F:16-F:32, instead of 1/5 at F:8.

Let us list some of the likely improvements in portraiture with the use of flash.

1. Normal quality of expression. (In shooting at 1/200 of a second, it is possible to wait until the expression is just right. There is no possibility that the subject will freeze up on you when exhorted to "hold it.")
2. Depth of field. (The volume of light furnished by the flash makes it possible to operate at a reduced aperture otherwise impracticable in the studio.)
3. Lack of movement. (Working at the high speed possible with the flash, the photographer may let his child or animal subjects wriggle to their hearts' content. With the absence of duress in posing, expressions are almost uni-

Figure 31.

"Annie"

Portraiture with single flash, diffused.

formly better. Solved also is the problem of making the animals face the light. The kittens in Figure 30 would have balked at a floodlight placed near them, but they barely blinked their eyes* when the flash bulb went off.)

4. Open eye and iris. An outstanding characteristic of flash portraiture is the open, candid expression of the eye. The dark pupil, normally open, or possibly a little dilated (if the work light in the studio is subdued), gives added brilliance.

5. No distress or distraction. (The use of flash puts the subject to about the least possible distress that is photographically feasible. He is not burnt to a crisp by high powered

* This is perhaps as good a place as any to mention that blinking of the eyes at a flash never shows in the picture. This reflex action always occurs, but thanks to our own faulty "synchronization," it does not take place until about 1/16 of a second too late. So, even with "open and shut" flash, there is no likelihood of catching the eye reaction in the picture. So momentary is the illumination of the flash, that subjects such as babies and animals, which are often severely frightened by ordinary lighting units, are in many cases not even aware of the firing of the bulb. At most, they lift an eyebrow.

Figure 32.

"Mollie"

One flash on subject, one on background.

Mazdas, nor is he made to feel like some quaint protozoon on a slide. If "pilot lights" are used, as suggested later in this chapter, they are turned off in ample time for the subject to regain his equanimity.)

Figures 31, 32 and 33 are examples of portraiture with flash. They demonstrate the advantages just enumerated.

It will no doubt be pointed out that shooting two or three flash bulbs with each exposure is expensive business for the photographer on a budget. The cost per exposure is higher, of course, but most operators will find that fewer exposures are required. With flash you can afford to wait until just the right moment arrives, instead of distractedly popping off a whole series of exposures, hoping to God you will get it in one of them.

Multiple Flash.

As will be seen in Figures 34 and 35, most of the set-ups advo-

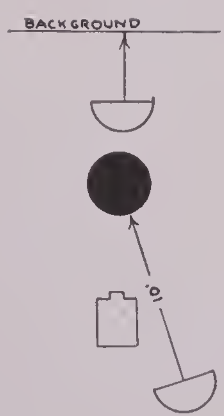

Figure 33. "Basic" type of lighting. One flash on subject, one on background.

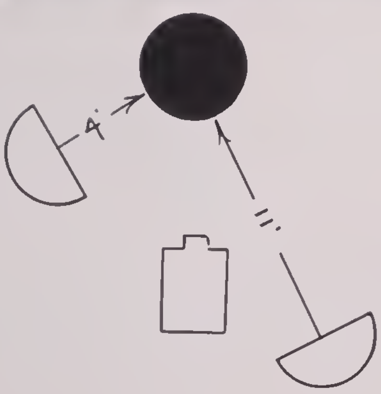

Figure 34. Multiple source lighting, one for illumination, one for "fill-in."

cated for portraiture require the use of *multiple-flash*—the synchronized firing of two or more flash bulbs. Even the set-up for the straight Basic Light, with only a single light source on or near the camera, requires an extension to illuminate the background.

The use of extensions introduces a few complications of which note should be taken. Since all modern synchronizers have facilities for plugging in extensions, no reference need be made to the "hook up" except to record that all lamps, together with the electro-magnetic synchronizer, are connected "in parallel."

The wire for extensions should be of the *heaviest gauge* that can conveniently be used. For extensions of twenty-five feet or less, #16 or #18 lamp cord* is generally large enough. Longer extensions, used with several large-sized bulbs, will require heavier wire, #14 or #12.

This limitation on the smallness of the wire is occasioned by the fact that added resistance in the line increases the time lag of the flash bulb. Too much resistance—due to small gauge wire or too long extension—will increase this lag to the point where synchronization is seriously affected. A resistance of one half of an ohm (approximately that of twenty-five feet of #18 lamp cord) will increase the lag by about 2 milliseconds, not enough to worry about. But a line resistance of one ohm (or fifty feet of #18 lamp cord) with a large-sized bulb (G. E. 21, for example) may extend the time lag by as much as 15 milliseconds, which is enough, at high shutter speeds, to completely demoralize synchronization.

The situation is further complicated by the small inherent resistance in the coil operating the electric type of synchronizer. With large external resistances, most of the current is thrown through the synchronizer coil, leading to erratic behavior by the flash lamps. The mechanical type of synchronizer is thus more accurate, with minimum amounts of battery power, than the electro-magnetic type, so far as multiple flash hook-ups are concerned.**

Failure of synchronization when extensions are used may be traced to several causes.

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* It is probably unnecessary to note that the smaller the gauge number, the larger the wire.

** For further data on the effect of line resistance on synchronization, see the article on Operating Characteristics of Photoflash Lamps and Synchronizers in The Journal of the Photographic Society of America, Volume VI, No. 4, October, 1940.

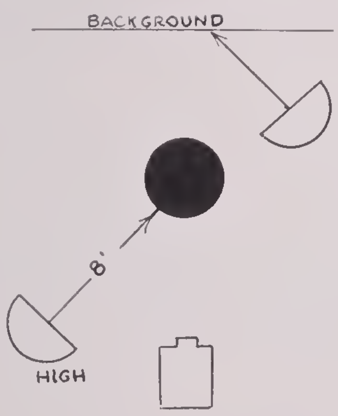

Figure 35. "Modified Basic" type of lighting. One flash (high) on subject, one on background. Light-area and background approximately matching in tone.

1. Too small wire in extension.
2. Too long an extension.
3. Too many or too large lamps.
4. Depleted batteries.
5. Faulty contacts (in lamp sockets, in extension plugs, in synchronizer itself).

The Background Light.

In the set-ups diagrammed in this chapter, it will be noted that they all call for an independent unit which illuminates the background only.

This unit is an essential part of the lighting system which I have outlined in *Pictorial Lighting** and which forms the basis for the methods suggested in this chapter. Its effect on the illumination of the subject is negligible, and it does not need to be allowed for in calculating exposure.

The background itself is a smooth white wall, or a tightly stretched sheet, at least six feet behind the subject.

The Use of Diffusion.

For close-up indoor shots in which one does not need the full potency of the bulb, the flash often gives too violent an illumination for the best results. Even with a "fill in" light, shadows are hard-edged, and the general effect is much too harsh for flattering portraiture.

It is therefore frequently advisable to *diffuse* one or more of the light sources. Various mediums may be used for this purpose. Thin *oiled silk*, such as is used for ice-box bowl covers, serves admirably. (Note the data in Kronquist's portrait of Diana, Figure 36.) Architect's *tracing paper*, mounted on a wire frame to be clipped to the reflector, is also a good diffuser. A common make-shift diffuser is a handkerchief draped over the reflector.

All these various diffusing mediums, of course, cut down the light in varying degrees, and each must be compensated for by a corresponding increase in the aperture. An accurate check on the effectiveness of any diffusing medium may be made by light meter

* Pictorial Lighting, by William Mortensen, Camera Craft, 1935.

"Diana Asleep"

Lawrence Kronquist

(Special photographer for Douglas Aircraft Co.)

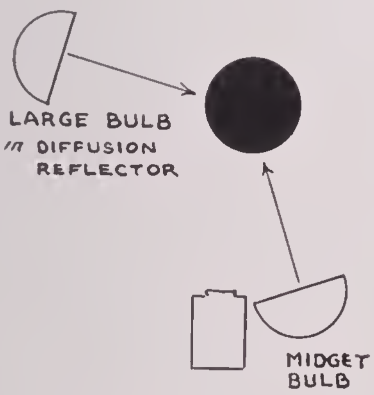

Figure 36. Another superlative baby portrait by Kronquist of Douglas, who gives the following details: "Diana Kronquist, the model, was too tired to pose any longer, went to sleep on the job, and this picture was the happy result. A 40,000 press bulb in a big reflector throws a large amount of light, but diffused, slightly in back of the subject to give modeling. A #5 peanut bulb on the camera reflector used as the fill-in—but here is the trick—a clear oiled silk food bowl cover with elastic edges, the kind used in electric refrigerators, was snapped over the reflector to soften and diffuse the light. This soft light helps bring out that delicate baby skin—so different from lighting an airplane or news shot—1/50 second—5¼ inch lens—same outfit as used on the B19. Agfa Triple S film, a soft high speed film, with Agfa 17, a fine grain soft working developer, was used in all these shots (including airplane stuff) to get nicely balanced negatives, without contrasty, burnt up highlights. Flash can be controlled as well as any other lights and has many advantages: it permits of stopping way down, it stops action when needed, and is light and compact for carrying around."

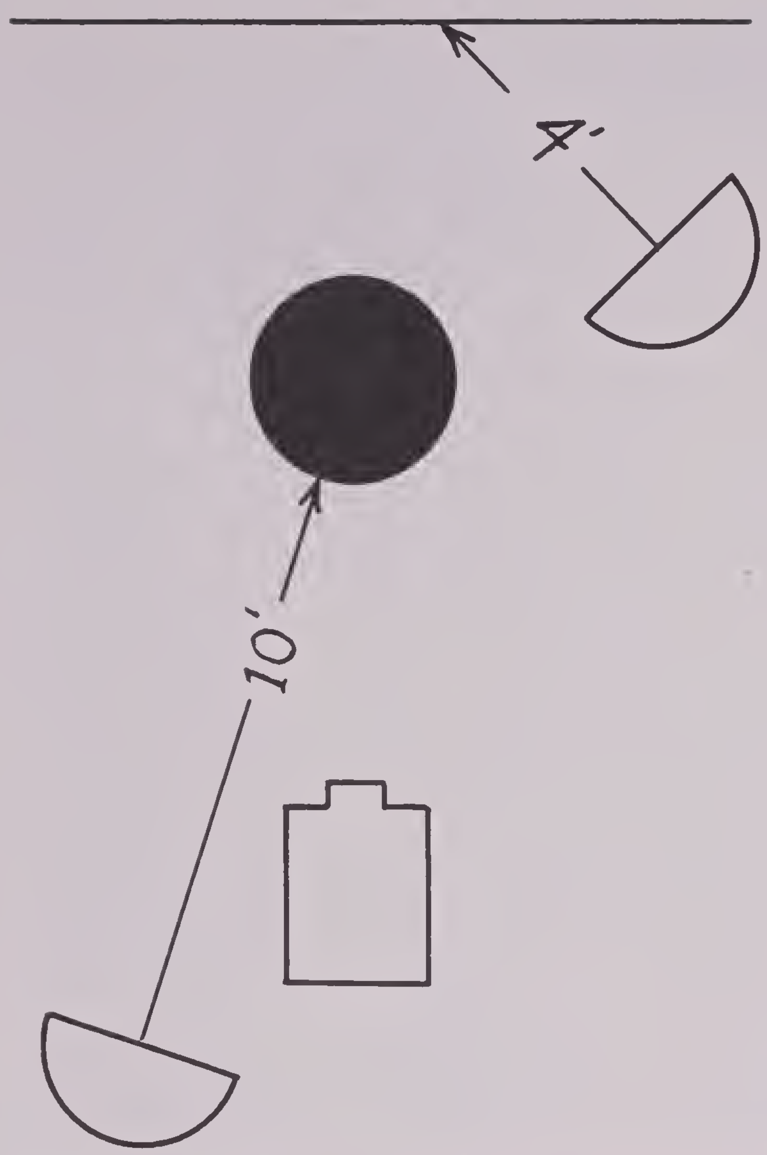

Figure 37.

Arrangement of flash units for Semi-Silhouette lighting used in Figure 37a. Characteristic of this lighting is the strongly illuminated background, with the flesh tones dark against it.

readings of any light source with and without the diffuser. The intensity of the flash will be reduced in the same proportion. The meter reading will also indicate the proper re-adjustment of aperture.

I have found the following data to be substantially correct:

1. *Oiled silk* cuts down the light to three-quarters of its strength. This necessitates opening up one half stop. (e.g., from F:16 to F:12.7).
2. *Tracing paper* reduces the light by one half. To compensate, open up diaphragm one full stop. (e.g., from F:16 to F:11.)
3. A thick cotton *handkerchief* cuts down the light to about one quarter of its former potency. To compensate, diaphragm should be opened two stops. (e.g., from F:16 to F:8.)

Set-ups for a Single Source.

In Figures 35 and 37 are shown two set-ups for portraiture by flash. Both these set-ups involve the use of only a single light source for illumination of the subject.

Figure 37a. Effect of the Semi-Silhouette light as diagrammed in Figure 37.

Figure 35 shows the arrangement of units for illumination approximating the effect of the Modified Basic Light. In other words, with this set-up, the tone of the light-areas (*not* the high-lights) of the face should be the same as that of the background.

The distances in Figure 35 are based on a medium complexion. For a face paler than average, it will be necessary to pull the front unit a little further back. Conversely, for a sun-tan or a dark complexion, the front unit must be moved a bit closer.

In Figure 37 is shown the set-up for the Semi-Silhouette Light. This diagram indicates the arrangement of flash units used for Figure 37a. With this lighting, the face should appear darker than the background. As in Figure 35, the set-up may have to undergo slight alterations to accomodate specific complexions.

Set-Ups for Double Source.

Figures 34, 39 and 40 show set-ups involving the use of two sources.

In these cases, the lighting is somewhat unbalanced and one of the lights serves simply as a "fill-in." The function of the "fill-in" is closely analogous to that of the reflector which is commonly used: to get additional luminosity into the shadows and to prevent the lighting from becoming too unbalanced.

Generally speaking, the fill-in light should be placed at about twice the distance of the main source. Under these conditions the fill-in gives one-quarter as much light as the main source (by the inverse square rule), which is about the right relationship.

The two lights should be placed near enough together so that there can be a merging of their areas of influence. The effect is very bad if the lights are so widely separated that one side of the face is illuminated almost exclusively by the main source while the other is lighted only by the fill-in. In general, the lights should never be placed so that lines drawn from them to the subject makes an angle larger than forty-five degrees.

Exposure with Multiple Flash.

Determination of correct exposure values with a multiple flash set-up, such as that shown in Figure 40, involves complexities not

Figure 38. Basic type of lighting, verging on Semi-Silhouette quality.

contemplated in the standard exposure tables reproduced on pages 44 to 49. Here we have an inter-relation of several lighting sources of varying intensities and distances from the subject.

For coping with this situation there are two suggested procedures.

One of these is that embodied in a rule of thumb advocated by some operators: base your exposure on the principal light source only and disregard all the rest. This procedure is permissible when a quick spur-of-the-moment calculation must be made, but it cannot yield the best results. It would be a comforting demonstration of mind-over-matter if, by merely disregarding a light source, we could prevent it from affecting the negative; but unfortunately it does not behave that way. If we "disregard" a light source, we will probably turn up with an unbalanced, over-exposed negative. The only light sources that may with any justification (and some degree of impunity) be disregarded are those which illuminate the background only, for good exposure is based in the light-area of the *subject.* Different effects may be achieved by deliberate over- or under-exposure of the background, but the subject must, of course, be correctly exposed under all conditions.

A much more sensible procedure is to take *all* the effective light sources into consideration. To calculate the combined effect of several sources at varying distances and of varying intensities involves a little mathematics—but nothing so much as you might imagine.

The principal point involved in the calculation is the translation of all F: values into their Uniform System (U.S.) equivalents. This translation is required because exposures and F: values are not directly comparable, the exposure series being geometrical and the F: series arithmetical in their progression. If you *double* the F: value, for example, you require *four times* the exposure. The Uniform System of aperture marking, however, is designed to be in direct simple relation with the corresponding series of exposures. (See Table XIII.) If, for example, your subject required 16 seconds at U.S. 16, it would require 8 seconds at U.S. 8 and 4 seconds at U.S. 4.

Let us see how this works out with two light sources. Suppose we have two equal lights. Either of them (let us say) requires an exposure of one-fifth second at U.S. 8. Both of them together,

Figure 39. Light from two sources.

however, would give twice as much light and, to keep the exposure at one-fifth, would require the diaphragm to be closed down to U.S. 16. Note that 16 equals 8 plus 8.

The rule, therefore, for multiple light sources is as follows: *For a given exposure, add together the U.S. aperture settings that would be required for each lamp if it were the sole source of illumination; the sum is the U.S. aperture value required for all the lamps operating together.*

For calculating multiple flash, the procedure becomes:

1. Decide upon your exposure.
2. At the given exposure, determine from the Tables on pages 44 to 49 the correct F: readings for each lamp.
3. Convert the F: readings into the corresponding U.S. values. See Table XIII.)
4. Take the sum of the U.S. values.
5. Convert the sum back into its corresponding F: value.
6. Set your lens at this F: value.

In terms of the sample set-up shown in Figure 40, the procedure is as follows:

Let us say that you are using "C" type of film, two G.E. No. 5's in special reflectors at 5 feet and 10 feet respectively, and you want to shoot at 1/200. On this basis, you look up in Tables IV to VIII or IX to XII the flash number for the given lamp-reflector combination. This is found to be 88. You then find the F: reading for each lamp.

$88 \div 10 = 8.8$ (Call it F:9)
$88 \div 5 = 17.6$ (Call it F:18)
Now refer to Table XIII:
F:9 = U.S. 5
F:18 = U.S. 20
$20 + 5 = 25$
U.S. 25 = F:20

Therefore, F:20 is the correct diaphragm setting for the set-up described above.

The mathematics herein involved is elementary enough but nothing that can be dashed off in the heat of a portrait sitting. Any

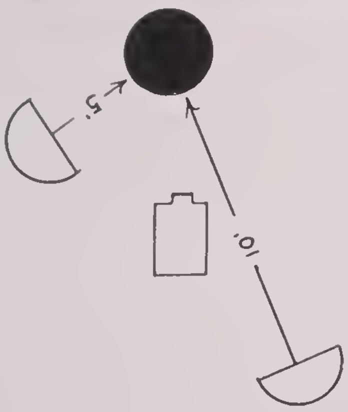

Figure 40. Light from two sources. Two G.E. #5, 1/200 at F:20.

photographer who intends to use flash in portraiture will, therefore, work on the basis of standardized set-ups arrived at by careful experimentation.

An excellent procedure, conducive to economy of time and materials, is to mark on the floor the position of sitter, camera, and lighting units.

Multiple flash, like single flash, is subject to all the disturbing aberrations mentioned in Chapter Four, Part One, viz.:

1. Variations in film speed.
2. Irregularities in bulb performance.
3. Irregularities in synchronizer.
4. Irregularity in shutter operation.
5. Uncertainties in reflector efficiency.
6. Reflecting surfaces surrounding subject.
7. Nature of subject matter.
8. Acts of God not otherwise specified.*

Necessarily, there is no allowance for these variables in exposure tables, which are doubtless as accurate as human ingenuity can make them. So the portraitist must take these tables and the derived values for multiple flash, not as the latest low-down from Sinai, but simply as a hand up, a steer in the right direction. Taken simply as a general guide, they may be very useful in helping him to arrive at his own standardized set-ups.

The diagrams accompanying Figures 35, 38 and 40 show three such set-ups which I have found useful in portraiture with the flash.

Determination of Exposure by "Pilot Light."

A more convenient and flexible method of determining exposure for portraiture by flash depends upon the use of an exposure meter with "pilot lights."

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* In justice to manufacturers, I hasten to point out that many of these variables are becoming less variable as products are improved.

Figure 41. The strength of flash illumination makes possible fine rendition of dark garments.

Table XIII

Comparative F: and U.S. values.

F:	U.S.	F:	U.S.
1.2	.1	10	6.5
1.4	.13	11	8
1.6	.16	12.7	10
1.8	.2	14	12.5
2	.25	16	16
2.2	.32	18	20
2.5	.4	20	25
2.8	.5	22	32
3.2	.65	25	40
3.5	.8	29	56
4	1	32	64
4.5	1.3	36	80
5	1.6	40	100
5.6	2	45	128
6.3	2.5	50	160
7	3	56	200
8	4	64	256
9	5	72	320

In absence of table, F: values may be converted to U.S. by the following formula: square the F: reading, divide by 16. (E.g., F:8 squared equals 64, which divided by 16 equals U.S. 4.) To convert from U.S. to F: values: multiply by 16, take the square root. (E.g., U.S. 4 times 16 equals 64, the square root of which is F:8.)

The pilot light system is based upon the use of conventional lighting units of known power which, in movie parlance, serve as "stand ins" for the flash units. Once the relationship is established between the pilot lights and flash units, the exposure for any set-up or combination of flash bulbs can be determined by a Weston meter without any recourse to the U.S. system, reference to exposure tables, or impromptu mathematics with "flash numbers."

For pilot lights I use my studio lighting units: two 500 watt T-20 lamps in "Solite" reflectors. The "Pilot Exposure" values listed below in Table XIV are derived from these units. The flash extension units may be conveniently clamped to the Solite stands.

Table XIV

Weston Pilot Numbers (with 500 watt Solites).

A. For between-the-lens shutters.

Actual Exposure	1/200	1/100	1/50
Wabash #0	½ sec.	1 sec.	2 sec.
Wabash #25 (regular reflector)	½ sec.	1 sec.	2 sec.
Wabash #25 (special reflector)	1¼ sec.	2½ sec.	5 sec.
Wabash #40	1¼ sec.	2½ sec.	5 sec.
Wabash #2	2½ sec.	5 sec.	10 sec.
G.E. #5 (special reflector)	1½ sec.	2½ sec.	4 sec.
G.E. #21	2½ sec.	3 sec.	6 sec.

B. For focal plane shutters.

Actual Exposure	1/200	1/400	1/800
Wabash #2A	½ sec.	¼ sec.	⅛ sec.
G.E. #31	4/5 sec.	2/5 sec.	1/5 sec.

I have chosen the 500 watt Solites as the standard since they are common equipment readily obtainable. Any 500 watt T-20 lamps in eight inch aluminum-painted reflectors should check fairly closely. If your two units, placed respectively 5 feet and 10 feet from a subject of medium complexion, give a Weston reading of *13*, the Pilot Exposure numbers in Table XIV may be followed exactly. Anyone may, with a little experimentation, work out the Pilot Exposure numbers for his own equipment, if they do not correspond with those in Table XIV.*

How to Use Pilot Numbers.

The procedure with pilot lighting is extremely simple. First, place your subject and make your set-up with the 500 watt Solites. With them determine your proper lighting angles and balance of intensities. If you intend to diffuse one or more of your flash units, put diffusers on the corresponding pilot units. For sake of proper balance, a 500 watt pilot unit should also be used on the background. (But note that the background unit does not figure in determining the exposure.)

* Appendix A describes the procedure for determining the Pilot Numbers for any type of lighting units.

When you have the pilot units placed and diffused to your satisfaction, turn off your background units and take your Weston meter reading. The meter should be previously set to the proper A, B or C speed of film (or according to the Kodachrome rating, if Kodachrome is to be used.)

Set the arrow on the reading given by the 500 watt pilot lights. From Table XIV determine the Pilot Number for the type of flash bulb and the actual exposure intended. Opposite the pilot exposure number on the meter scale will be found the proper F: setting for the given exposure and bulb.

For example: You intend using two Wabash 25's in regular reflectors, shooting at 1/200. Table XIV gives for this combination a Pilot Number of "½ sec." You are using "A" film; so you set your meter at 64. Let us say that your set-up with two 500 watt Solites gives a reading of 6.5. Set the arrow at 6.5. Now look on the circular scale until you find your Pilot Number, "½ sec." Opposite, you will find F:16, which is the proper diaphragm setting for a corresponding set-up with Wabash 25's in regular reflectors at 1/200.

You may find that the indicated F: setting is smaller than your camera is capable of. In this case, you have a choice of five alternatives:

1. Diffuse the lights.
2. Move the lights further back.
3. Switch to a smaller flash bulb.
4. Switch to slower film.
5. Use shorter exposure.

Or you may resort to any combination of these until you obtain a reading compatible with your camera.

Advantages of the Pilot System.

For purposes of portraiture by flash, the advantages of the Pilot System are almost too numerous to mention. At one step, the meter reading automatically takes account of all the variables that make the determination of flash exposures into such a prodigiously complicated equation. Let me list some of these variables which the pilot system takes care of:

1. *Film speed* is taken care of by the meter setting.

"Secretary Morgenthau" *Otto Hagel*

Courtesy, Time, Inc.

Figure 42. Contemporary magazine illustration provides excellent examples of flash portraiture.

2. There is no need to measure lamp distances.
3. There is no hasty mathematics with *flash numbers.*
4. *Diffusion* of the sources is automatically compensated for.
5. So also is *reflection* from surrounding surfaces.
6. So also is the light or dark *complexion of the subject.*

In addition to all these is the outstanding advantage of being able to see *beforehand* just what kind of lighting your set-up is going to yield.

There is only one limitation to the use of the pilot system: *All flash bulbs used in a given set-up must be of the same size.* That is, with the pilot system, you could not accurately determine the proper F: setting if you were going to use simultaneously one G.E. #5 and one Wabash #2. If it were for any reason necessary to use such a combination, you would need to follow the method described earlier in this chapter: use of "flash numbers" and conversion of F: values into the Uniform System.

Chapter Three

Sun-plus-Flash

It seems fantastic, at first glance, to talk of bringing artificial light into collaboration with the sun. But actually such is the amazing power of flash bulbs that they can work with the sun on quite even terms. Indeed, if you care to force the issue, flash bulbs can, within their limited radius, make the sun itself play second fiddle and perform the menial function of a fill-in light. (Such effects as the last, however, as we shall see, are seldom pleasant.)

The act of combining the illumination of the sun with that of a synchronized flash-bulb was some years ago marked with the handy label of "synchro-sunlight photography" (a phrase coined, I believe, by Kalart). We will use the same convenient term in this chapter.

The Dilemma of Outdoor Photography.

Synchro-sunlight offers a partial solution at least, to the common dilemma encountered in outdoor photography. In sunlight there is frequently a longer range of contrasts than the photographic medium is able to cope with. If, in such a case, the exposure is based on the light area of the subject (a procedure generally preferable in pictorial photography), the shadow areas are left pitch black and empty of detail. And if the exposure is based on the shadow areas (formerly a standard procedure), the light areas are hopelessly over-exposed and deprived of all gradation. And if, in final desperation, you try to expose somewhere in between, you turn up with *both* your light area *and* your shadows in very bad shape.

In this unpleasant predicament, the standard remedy was the use of the #3 type of negative.* This is a compromise negative, exposed for the shadow area, but plucked from the developer before the light-areas block up. The product thus obtained is printable, but deficient in photographic quality; for, although plucking from the developer may keep the light areas from becoming unprintably opaque, it cannot restore the half-tones that have already been destroyed by over-exposure.

Much to be preferred for pictorial uses is the 7D negative,** a negative exposed for the light area of the subject (where the most interesting half tones lie) and fully developed (in order to get adequate drawing in the shadows). The 7D negative, however, has been impossible to use with a contrasty light, and for much outdoor photography it has been found necessary to fall back on the unsatisfactory make-shift of Negative #3.

Only under certain restricted conditions has it been possible to use the 7D procedure for negatives shot outdoors. Here are some of the conditions that make its use feasible:

1. Low sun veiled with clouds.
2. High fog or thin clouds covering most of sky.
3. Ample reflection from large areas.
    a. White wall or side of building.
    b. Sidewalk.
    c. Beach.
    d. Body of water.
    e. Large cumulus clouds in quarter of sky opposite to sun.
    f. Artificial reflectors.***

---

* This is the terminology employed in the writer's book, Mortensen on the Negative, Simon & Schuster, 1940.

** See Mortensen on the Negative, page 167.

*** For fuller detail on outdoor lighting, see Outdoor Portraiture, Camera Craft, 1940.

"*Sea Breeze*" *William Mortensen*

Single flash bulb fills in shadows (in 1:8 illumination), catches detail in drape, stops action, and slightly darkens sky.

In the absence of such conditions, as we have said, the 7D negative cannot be used. And, very often indeed, these mitigating circumstances are lacking.

The device of synchro-sunlight, however, enables one to use the 7D negative under practically all lighting conditions. It is no longer necessary to depend upon reflecting elements or diffusion by clouds to reduce the natural contrast of sunlight. By means of synchronized flash bulbs it is possible to throw enough light into the shadow area to diminish the range of contrast into something that the photographic medium can handle.

The basic idea of synchro-sunlight is readily understood; but its proper use is not easily accomplished. Very definitely you must know just why you use it, when to use it, and how to use it. Merely popping a flash bulb in an outdoor setting does not constitute synchro-sunlight photography. Far worse than an outdoor shot with black shadows and blasted highlights (for this at least has a certain honesty) is a picture in which the sun-plus-flash procedure is ineptly used.

In this chapter we will consider some of the more reasonable and pictorially defensible applications of synchro-sunlight and also point out some of its more appalling abuses.

Equipment.

But before we talk about synchro-sunlight procedure, let us briefly consider the equipment needed.

1. *Camera* should have shutter speeds as high as 1/200 and be capable of being stopped down as far as F:22.
2. A *lens shade* should be used for all outdoor photography.
3. Use of *tripod* is advisable, since this leaves the photographer free to move about and operate bulb from desired distance.
4. *Synchronizer* should be rigged with a ten foot *extension* so that battery case and reflector can be carried about and camera operated at a distance.
5. A *diffuser* of some sort is required—any of the types mentioned in the preceding chapter.
6. A supply of *bulbs* of three different sizes is needed. G.E. #5, #16A and #21 make a good assortment. So also do Wabash #25, #40 and #2.
7. Two *reflectors*, one regular, one rifle beam type.
8. A good *exposure meter* is an almost absolute necessity under these conditions.

Light and Shadow.

Compare the two examples shown in Figures 44 and 45. The intensity of sunlight on both is identical—Weston 400. Yet the two pictures are entirely different in effect: Figure 44 has unpleasantly dense shadows, while Figure 45 shows fine gradation in the face. The origin of the difference between the two is, of course, that Figure 44 was taken out in the open, while Figure 45 was taken close to a white wall which threw a strong reflection into the shadow areas.

The difference in the shadow reading tells the tale. In Figure

"Breton Folk" *William Mortensen*

Figure 43. The S:L ratio was 100:800. Fill-in with one Wabash "25" at 16 feet. Bulb should have been slightly closer, as contrast remains a little too great.

Figure 44. Weston reading of 400 in light-area, 50 in shadows.

Figure 45. Light area same as Figure 44. Shadows boosted to 200 by reflection from adjacent white wall.

44, the Weston reading for the shadow area of the face was 50, a ratio to the light area of 1 to 8. In Figure 45, close to the reflecting wall, the shadow reading was 200, a ratio to the light area of 1 to 2.

It is this ratio which determines whether or not the range of luminosities is photographically usable. It is not a matter of the blackness of the shadows or of the brightness of the light-area, but of the *ratio* between the two.

In outdoor photography, it is most important that attention be given to this ratio. If a meter is used, readings should be taken of the shadows as well as the light area. The mere fact that the reading for the light-area is 400 tells you very little about the state of affairs. Is the shadow reading 25, or 50, or 200? Knowing the ratio between the two, you have a clear idea of the photographic possibilities of the situation.

In Figure 46 are shown examples of subjects involving S:L ratios of 1:1, 1:2, 1:4, 1:8 and 1:16. All negatives were of the 7-D type, exposed for the light-area and fully developed.

Figure 46a.

Figure 46b.

Figure 46c.

Figure 46d.

Figure 46e.

Figure 46. These pictures illustrate five different versions of the S:L ratio. All negatives were of 7-D type (exposed for light-area, fully developed.)

A. S:L ratio 1:1.
B. S:L ratio 1:2.
C. S:L ratio 1:4.
D. S:L ratio 1:8.
E. S:L ratio 1:16.

The Basic Ratio.

For photography outdoors, we may set up the ratio of *1 to 4* as the preferable relationship between the shadow and light-areas in the face of your model. Figure 47 is a straight photograph without flash taken under conditions where this relationship prevailed. Actual Weston meter readings were 100 for the shadow area and 400 for the light area of the face.

Note that I say "the *face* of the model." Naturally, there will be numerous *darker* areas in the picture—in the hair, in shadows in the costume, etc. There may also be *brighter* areas—light-catching elements in the background, or the sky itself. But we are postulating our lighting, and our exposure, on getting the best possible gradation in the area that is presumably of greatest interest to us, *the face of the model.*

In the present case, of course, we are dealing with portraiture, with the best representation of flesh tones. But the flesh tone will serve as a norm for many other types of pictorial material. This 1:4 relationship is a good thing to aim at with all sorts of subject matter. Naturally, the whole range of the picture will usually constitute a much larger ratio, but (if it's a good picture) the dominating element should be capable of being presented in a S:L ratio no more than 1:4. We shall have more to say about this point in the next chapter.

This ratio of 1:4 may seem a bit arbitrary, but it has been determined by extensive experimentation. Of course, with sufficient reason, it may be violated on occasion. A particular dramatic effect may justify a higher ratio, just as a decorative effect may justify a lower one. But, for sound photographic results, 1:4 will be found a good working formula.

It should be noted, lest there be any misunderstanding, that the S:L ratio of 1:4 is postulated on the use of the 7-D negative. With the use of restricted development, it is possible to deal with much larger ratios. But this procedure always involves the loss of *full* gradation in the area where you want it the most—the face of the subject.

The Ratio at Work.

Early in your survey of a tentative outdoor set-up, take meter

Figure 47.

Soft sunlight giving an actual S:L ratio of 1:4, 100:400 in this case. A 7-D negative.

readings of the light area and shadow area of the face of your subject. The ratio between the two will tell you the needs of the situation. If the ratio is 1:4 or less, you may shoot for a 7D negative and be sure of excellent photographic results. If it is greater than 1:4, you may (if you have no other means at hand) have to be content with a #3 negative. Far better in such a case, you should start looking about for a natural means of reflection, or else resort to synchro-sunlight photography.

Choice of Set-Up for Synchro-Sun.

Having determined by your meter reading that you must make a synchro-sunlight shot, you must next discover the proper set-up for your flash-sun combination.

In certain special instances, which we will mention later, the sun is made to serve as the fill-in light. However, in the present instance,

Figure 48. Illogical illumination. A bad beginning for sun-plus-flash.

Figure 49. Logical illumination, although contrasty. A good beginning for sun-plus-flash.

we are considering the sun in its logical and much more common use as the principal source.

In their respective functions as principal source and fill-in, the sun and the flash are subject to much the same limitations as we prescribed, in the preceding chapter, for the main and subsidiary lights in portraiture. Leaving aside the blackness of the shadows, the *angle* of the sun should be photographically agreeable. Since we are dealing with an outdoor setting, a somewhat more extreme angle may be tolerated than would be in the studio; but, without the fill-in, the face must still be logically illuminated. Compare Figures 48 and 49. Although the shadows are too dense in Figure 49, the illumination is sensible and takes care of the principal points of interest, which are completely overlooked in Figure 48. Figure 49 is a good beginning for a synchro-sunlight picture, Figure 48 is not. Although the flash gives one somewhat increased freedom in the selection of backgrounds, the basic limitation imposed by the angle of the sunlight must never be lost sight of.

On analogy with the rule suggested for portraiture, one should avoid too wide an angle between the two axes of illumination. For

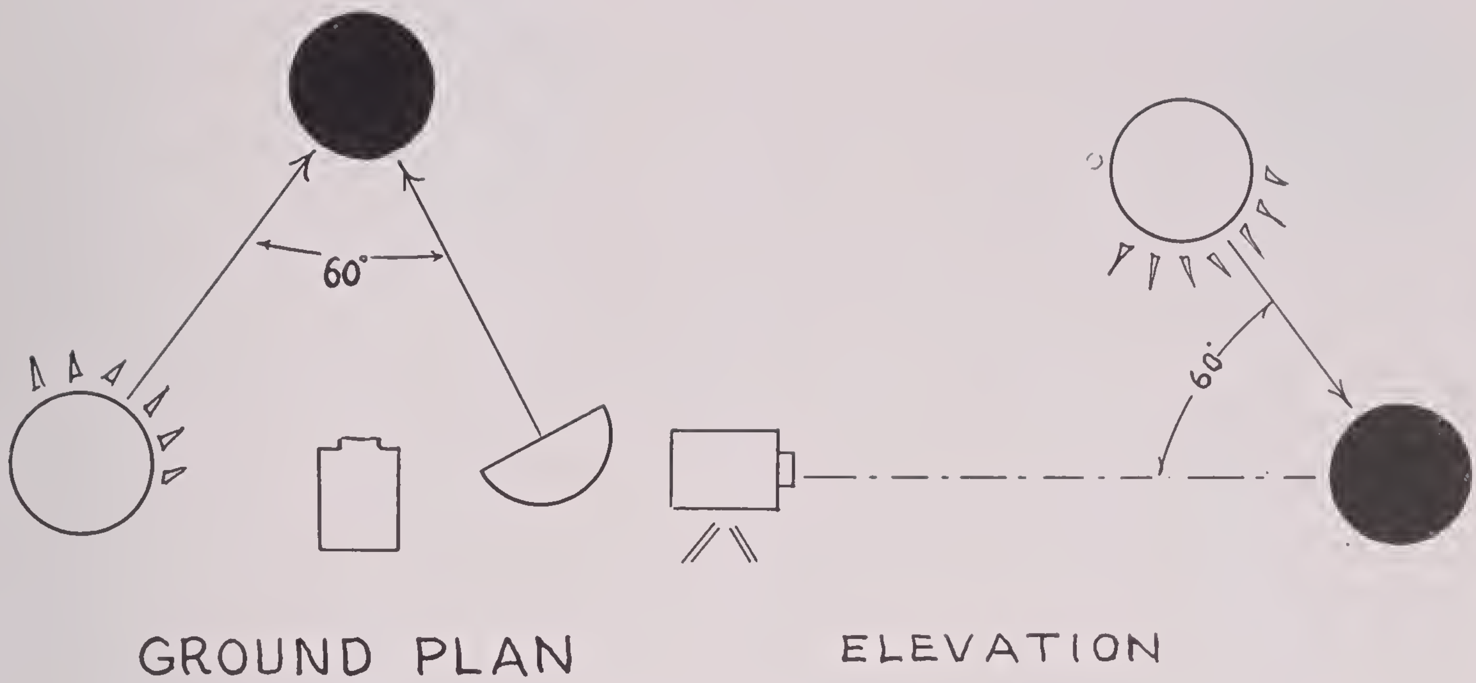


Figure 50. Sun-source and flash-source should not be separated more widely than 60 degrees in either horizontal or vertical plane.

studio portraiture we suggested 45 degrees as the widest permissable angle between the two light sources. In an outdoor setting, we may tolerate a slightly wider separation, sometimes as much as 60 degrees. It should be noted that this angle functions in *three dimensions* and also indicates the highest acceptable elevation of the sun. (See Figure 50.)

Position of Fill-In-Unit.

Nearly all the adjustment of the fill-in unit will take place along the axis of the camera, moving nearer to or further away from the subject. There is never any occasion for the position of the fill-in source to deviate more than 10 degrees from the axis of the camera. (See Figure 51.) After all, we are interested only in illuminating the area that the camera can "see." If the fill-in unit is moved too far to one side, it wastes its energy in lighting up the neutral territory back of the model's head. With the fill-in source kept near the axis, there is better opportunity for *merging* of the areas affected by the two sources. Synchro-sunlight is not a matter of two isolated areas, illuminated separately by two sources as in Figure 52. It is properly a matter of either two or three *merged* areas. Two merged areas are shown in Figure 53, one area lighted by fill-in, the other by sun plus fill-in. Three merged areas occur when the fill-in is slightly separated from the camera axis: one area lighted by the sun, one by the fill-in, and one by both sources.

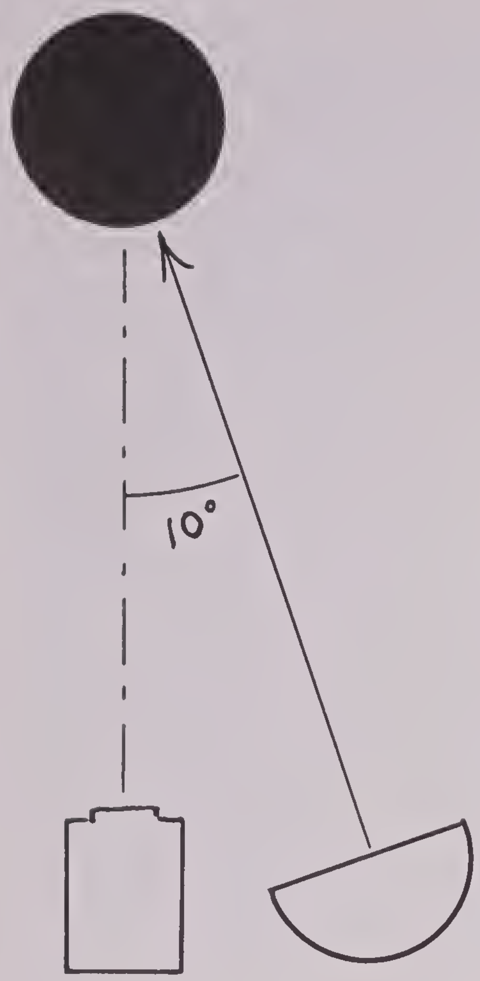


Figure 51. Fill-in light should stay close to the axis of the camera.

Lighting on the isolated area plan, as in Figure 52, is nearly always tricky and false in effect, and quite out of place in an outdoor setting. Use of the merged area scheme, however, as in Figure 53, will produce, if the two sources are properly balanced, an *honest* sort of illumination, genuinely daylight in its effect.

Balancing the Fill-In.

Working with a single flash indoors (as described in Chapter One), you may operate on a basic exposure and control the effect of the flash merely by altering the F: value. But in multiple flash (as described in Chapter Two), altering the F: value affects only the *combined* exposure. To vary the relationship of the bulbs, you must apply various controls to the lamps themselves—diffusing one or the other, changing their relative distances from the subject, etc. In synchro-sunlight, you have fundamentally the same set-up as in multiple flash, except that you can control only *one* of the light sources—you can't hang a diffuser on the sun, or move it forty-five million miles closer.

I labor this rather obvious point, because there seems to be misapprehension about it among amateurs who are commencing work

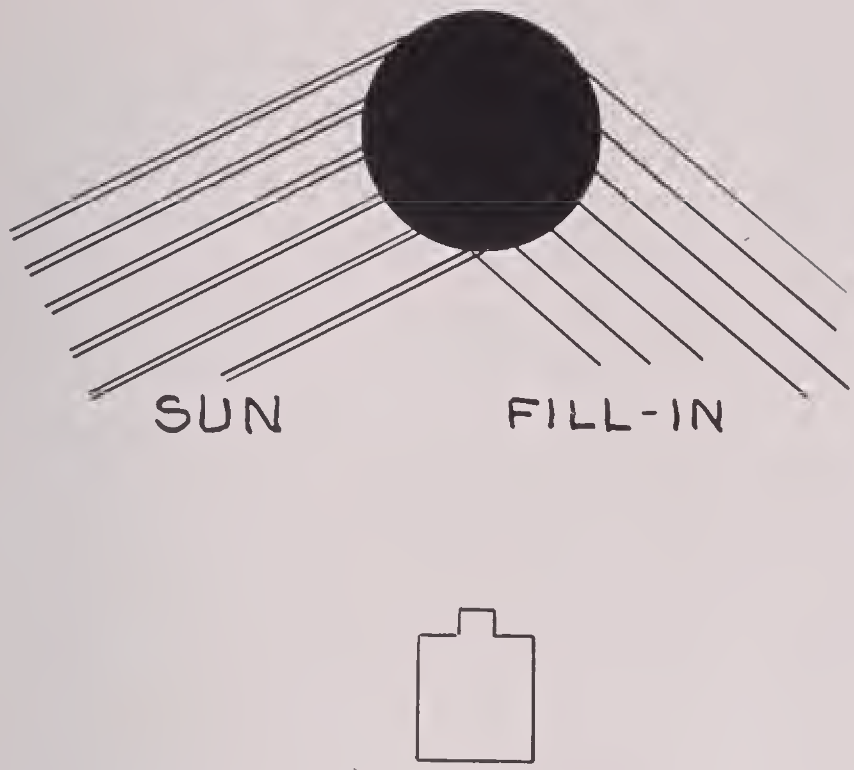


Figure 52. This is wrong relationship of sun and fill-in.

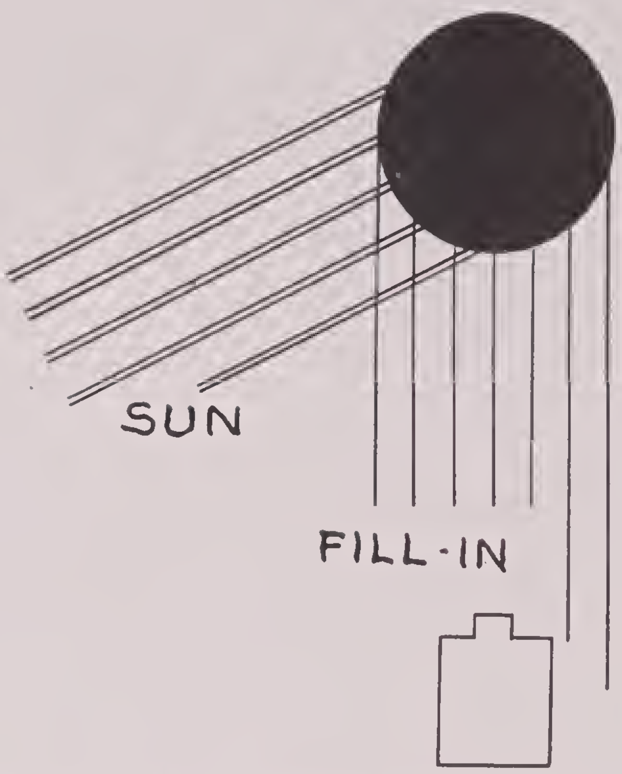


Figure 53. Sun and fill-in should overlap, producing merged areas of illumination.

with the flash. When they find, for instance, that their flash unit to too bright (as in Figure 54), they are apt to try to correct it by closing down the diaphragm. This does no good, of course, as it affects only the combined exposure of flash and sun. They could close down clear to F:128—at which point, no doubt, they would be vastly under-exposed—but they wouldn't thereby affect their faulty light balance by one iota. Only by reducing the brightness of the flash unit in Figure 55 (or, conversely, by waiting until the sun became a good deal brighter) would it be possible to arrive at a proper balance.

There are *four* means at hand with which to control the brightness of the flash unit in synchro-sunlight procedure:

1. Changing the size of bulb.
2. Changing type of reflector (regular or rifle-beam).
3. Use of diffuser.
4. Varying distance of light from subject.

If your flash unit is anchored to your camera, you will be obliged to use one or more of the first three methods. However, if your unit is rigged with an extension, much more standardized results may be secured by keeping to a single size of bulb and using the fourth method exclusively. Thanks to our friend, the law of inverse squares, it is possible to secure huge variations of intensity by relatively small variations in distance. By measuring distances you have an accurate check on the illumination you are getting; whereas, if you juggle bulbs, reflectors and diffusers about, you are most apt to lose your bearings completely.

Determination of Balance: By Guess and By God.

The determination, in synchro-sunlight procedure, of the proper strength and distance for your flash unit has always proved a tough problem for the amateur (not to mention the professional). In meeting the situation, two highly unscientific methods have been practiced with verying degrees of success.

One is the method advocated by a press photographer of my acquaintance. His procedure runs something like this: He keeps his flash unit attached to his camera, uses a G. E. 21 or Wabash 40 at all times, and observes the following rule: "When the subject is nearer the camera than 10 feet, expose for the flash; when the subject is beyond 10 feet, expose for the sun."

Of course, this does not pretend to be more than a safe journalistic dodge for always getting *some* sort of a picture. Good photographic quality and correct lighting balance will result from this method only by accident.

Speaking of accidents brings us naturally to the second of our unscientific methods, one that is practiced much more widely and in much more austere circles than is commonly admitted. This is it: Make a large number of shots, with the flash unit close in, far away, and at a considerable variety of distances in between. Triumphantly print up the best one of the lot and discreetly forget about the rest.

Judged on the basis of the carefully chosen results that the public is permitted to see, this would seem an excellent method. But it is a time-wasting procedure as well as (with bulbs at 11¢ to 25¢ per) an expensive one. Besides a guy likes to feel that he—and not Lady Luck—has had *something* to do with the making of his picture.

Determination of Balance: A More Scientific Method.

Happily for the self-respect of the photographer (as well as for

Figure 54. Flash too bright. This cannot be corrected by closing down the diaphragm.

Figure 55. Over-balance of flash in Figure 54 corrected by moving flash unit further back.

his bank account), a rather more scientific approach to the question is possible.

But first, in order to be sure that we understand what our problem involves, let us take a moment to review its essential points:

1. You have a *model* in an outdoor setting.
2. You have an *invariable light source*—the sun.
3. You have a *variable light source*—your flash unit.
4. You have a *light area* in the model's face.
5. You have *shadow area* in the model's face.
6. The *ratio* between these two areas is greater than the acceptable basic ratio of 1:4.
7. You want to know at what *distance* to put your flash unit to produce a 1:4 ratio in the model's face.
8. You want to know what *exposure* to give the whole set-up.

For clarification of the problem, we assume the following points:

1. That your flash unit is detachable from your camera and may be operated through a long extension.
2. That your flash bulb is a Wabash "40."
3. That you are shooting at 1/200 (a good basic exposure for

flash).

4. That you are using A type of film.*

Since, according to our conditions, the ratio of shadow to light area is greater than 1:4, we must therefore find a position of the flash unit which will bring just enough illumination to the subject to boost the shadow area until it conforms to the 1:4 ratio. The situation is a little more complicated than it appears at first glance, since the illumination from the flash unit is added to the light area as well as to the shadows. (See Figures 50 and 53.) You must, therefore, find an amount of light that, when it is added to both sides, will produce a final ratio of 1:4. Resorting to a bit of your elementary algebra, it would have to be an amount that would satisfy the following equation:

$$\frac{S + X}{L + X} = \frac{1}{4},$$

in which *X* equals the unknown amount of light, *S* the shadow reading, and *L* the reading for the light-area. Solving it for *X*, we produce

$$X = \frac{L - 4S}{3}.$$

In other words, in order to find the additional amount of light required to produce a 1:4 ratio when added to both light and shadow areas, multiply the shadow reading by 4, subtract the product from the light-area reading, and divide the remainder by 3.**

---

* Since the sun is the main source, figure the film at its DAYLIGHT rating.

** This formula is included to show the mathematical basis of the "common increment," the value that must be added to both sides to bring about an S:L ratio of 1:4. In practice, it is more convenient to refer to Table XV, which gives the increment for the common values of 1:8, 1:16 and 1:32 ratios. It will be found that most exterior S:L ratios fall readily into one of these three categories. Slight deviations may usually be safely ignored (treating 1:10 as 1:8, 1:13 as 1:16, etc.), since probable errors from other sources are more than enough to make meticulous accuracy meaningless. For those who want the whole story, however, I include a table of factors for determining the increment "I" for any given ratio.

TABLE XVII

Ratio, S:L	Factor	Ratio, S:L	Factor
1:4	0	1:20	5.3
1:5	0.3	1:25	7
1:6.5	0.8	1:32	9.3
1:8	1.3	1:40	12
1:10	2	1:50	15.3
1:13	3	1:64	20
1:16	4		

To obtain increment necessary to produce 1:4 ratios: (1) Determine ratio represented by your S:L relationship (i.e., 1:5, 1:13, etc.). (2) Multiply S value by factor proper to your ratio. (3) Product is desired increment. For example: your shadow and light readings are 13 and 130, a 1:10 ratio. Factor for 1:10 is 2. 13 × 2 = 26 (call it 25), which is the increment.

These factors may be used with either Weston or General Electric meter readings.

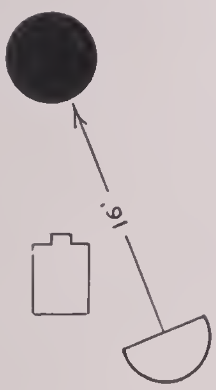
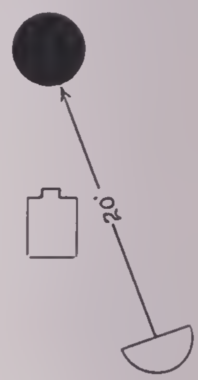


Figure 56. Originally a 1:8 ratio, 50:400. Necessary increment of 65 secured with one Wabash "25" at 16 feet.

Figure 57.

Figure 58.

Flesh against a brilliant grey sky, a difficult problem without the use of flash. Increment should be sufficient to lift light-area of face to same tone as sky. Flash in Figure 58 is slightly overdone. Mere filtering could not produce such a correction.



Since it is something which is *added* to *both* shadow and light areas, I have designated this value as the "common increment." This phrase is chosen, not to impress the reader, but simply because I had to have some sort of convenient handle to apply to the value. "Common increment" means, then, *the amount of light that must be simultaneously added to both shadow and light areas to bring them into a relationship of 1:4.**

* The preceding formula is for the purpose of producing a final ratio of 1:4. This is the generally ideal ratio. Increments may be calculated, however, to produce any desired ratio. The basic formula for this purpose is

$$I = \frac{L - nS}{n - 1},$$

in which n is the denominator of the desired ratio. If, for example, you were seeking a ratio of 1:8, the value of n would be 8.

Figure 59.

Figure 60.

The original S:L ratio was 50:800, or 1:16, in which S was the reading for the face and L the reading for the sky. Figure 59 was exposed for S, which gives a silhouette against a blank sky. By flash the face is raised to nearly 1:1 relationship with the sky, producing an effect analogous to the Basic Light. This calls for an increment of about 650, furnished by a Wabash "40" at 8 feet.

It must be remembered that, in calculating the common increment, the *actual* light values are just as important as their ratio. You might have, for instance, meter readings of 2 and 16 in one case, and of 100 and 800 in the other. The ratio in the two cases is identical (1:8), but the required increments would, of course, be quite different (about 2.5 in the first case and 130 in the second).

Calculating "I" by Use of Meter.

The increment "I," which must be added to both sides to bring about a ratio of 1:4, may be calculated from the Weston meter dial without reference to the formula. The procedure is as follows: After taking the reading for both shadow and light-areas, set point "C" on the dial opposite the first division to the right of the reading for

Figure 61.

Figures 61, 62, 63, 64, 65.

This group notes the progress of the flash unit, from a position much too close back to the distance that gives the desired 1:4 rendering. Figure 61 is without flash, with an S:L ratio of 25:200. Proper increment is 32. Flash (Wabash "25") is 6 feet distant in Figure 62, much too close. Distance in Figure 63 is 11 feet; in Figure 64, 16 feet. In Figure 65, the distance is 22 feet, which gives the proper relationship. Table XVI indicates 22 feet as the correct distance for an increment of 32.

the light-area. Now note the difference between the value indicated by "A" and the first division to the right of the indicated shadow reading. This difference is the increment.

For example: Your shadow and light area read respectively 50 and 400. You set point "C" on the meter dial one division to the right of 400. Point "A" is now one division to the right of 100, value 130. Note first division to right of 50 (the shadow reading). This has a value of 65. 130 minus 65 equals 65, the value of the increment "I."

Use of this method requires that one know, or have ready access to, the values of the intermediate, unnumbered divisions on the Weston meter dial. These values are not hard to remember if one simply bears in mind that the same sequence 10, 13, 16, 20, 25, 32, 40, 50, 65, 80, 100, repeats itself *four* times on the dial: from 0.1 to 1, from 1 to 10, from 10 to 100, and from 100 to 1000. In fact, all one actually needs to remember are the first three numbers, 10, 13 and 16, and continue redoubling this short sequence.

Reading "I" from Scale.

With a little practice, increments may be read directly off the

Figure 62.

Figure 63.

Figure 64.

Figure 65.

Figure 66. *Figure 67.*

"Backlighting" is an effect that one must be very chary of using, but it is sometimes appropriate in an outdoor setting. Original S:L ratio in Figure 66 was 1:16. Increment in this case was chosen to build flesh up only to 1:8 ratio. Exposure in Figure 67 was based on light area of face. This combination retains brilliance of sun on hair and slightly darkens background.

scale along the bottom of Table XVI. The procedure is as follows:

> *For 1:8 ratio.* Take next small division to right of S value as shown on scale in Table XVI. E.g., for S value of 50, increment is 65.
>
> *For 1:16 ratio.* Take second major division to right of S value on scale. E.g., for S value of 50, increment is 200.
>
> *For 1:32 ratio.* Take three major divisions plus one small division to right of S value on scale. Or, more simply, multiply S value by 10. E.g., for S value of 13, increment is 130. (This is an approximation, but sufficiently accurate for use.)

This method may be applied to either the Weston or General Electric scale in Figure XVI.

Application of the Increment.

Let us now consider a concrete instance. Suppose the model is in contrasty sunlight. You take a Weston reading on his (or her)

Figure 68.

Figure 69.

A face "lit up like a lantern" is exhibited in Figure 69. Despite the opaque shadows, Figure 68 is felt as more pleasing and honest illumination.

face: shadows 50, light-area 400. Here, the ratio is 1:8, obviously too contrasty. Your problem, then, is to find the common increment which, added to both shadow and light areas, will raise them to a ratio of 1:4. Figuring from the formula

$$X = \frac{L - 4S}{3},$$

or resorting to Table XV, you find that the required value is 65.*

You now know that in order to get your balance, you will have to put your flash unit at such distance from the subject that it would boost the meter reading up 65 points, to 115 in the shadows and to 465 in the light-area. How do you determine this distance? You could (knowing the "flash number" of the bulb and its loss of efficiency out of doors) figure it out for yourself; but it is much more convenient to look at Table XVI. Here are correct distances, experi-

* $50 + 65 = 115.\ 400 + 65 = 465.\ \frac{115}{465} = \frac{1}{4}$ (approx.)

mentally checked, for several types of bulbs, and for all increment values from 0.4 to 1600.

From Table XVI it appears that, for a desired increment of 65, the Wabash 40 bulb would have to be placed at a distance of 25 feet from the subject.

The final point to be checked is the *exposure* required by the sun-plus-flash combination. To determine this, we take the sum of the reading for the light-area (400) plus the increment (65). Since we are aiming for a 7D negative, based on the *actual* value of the light-area, 465 is the number we must expose for. So set the arrow of your meter to 500 (which is the closest setting to 465). If you are shooting at 1/200, and are using A type of film, this calls for a diaphragm setting of F: 18. The series in Figures 61 to 65 clearly illustrate the working out of this principal.

Meters.

The two most popular and generally used light meters are those manufactured by Weston and General Electric. Both are excellent products and are, with correct handling, as accurate as such instruments can be. There are, however, important differences in the calibration of the two meters. The General Electric meter uses a straight arithmetic scale of "foot candles." The scale on the Weston meter is a geometric one, corresponding to the geometric progression of exposures and F: values. On account of this fact, the two scales are difficult to compare. Of the two, the Weston scale is more readily applicable to the "increment system," herewith outlined, for determining proper balance in sun-plus-flash pictures. However, in order that users of General Electric meters may make use of the system, we have attached to the graph in Table XVI a scale of approximately corresponding G. E. light values. The values below 65 on the G. E. scale will be read with the cover open, those above 65, with the cover closed.

The increment values in Table XV for all standard ratios are given in both General Electric and Weston versions.

Table XV

Weston Scale 1:8 ratios	Increment	General Electric Scale 1:8 ratios	Increment
6.5: 50	8	2.2: 18	2.8
13 : 100	16	4.5: 36	5.6
25 : 200	32	9 : 72	11
50 : 400	65	18 :140	22
100 : 800	130	36 :290	45
200 :1600	250	72 :560	90
1:16 ratios		1:16 ratios	
6.5: 100	25	2.2: 36	9
13 : 200	50	4.5: 72	18
25 : 400	100	9 :140	36
50 : 800	200	18 :290	92
100 :1600	400	36 :560	140
1:32 ratios		1:32 ratios	
6.5: 200	55	2.2: 72	21
13 : 400	110	4.5:140	42
25 : 800	220	9 :290	84
50 :1600	440	18 :560	168

For determining increment with odd ratios — 1:5, 1:6.5, 1:10, etc. — use formula or factors in Table XVIII (page 116).

Summary of Procedure for Sun-Plus Flash.

Let us now summarize the principal points in the procedure for making a picture with the combination of sunlight and synchronized flash.

1. Check the angle of the sun. Place the model so as to get best possible lighting from sun only.
2. Take meter readings of shadow and light-area of model's face.
3. Note the ratio S:L. If it is no greater than 1:4, there is no need of using flash for fill-in.
4. If ratio S:L is greater than 1.4, determine, by formula or from Table XV, the necessary "common increment" which the flash must supply. This increment, (I), added to both S and L brings them into a relationship of 1:4.
5. From Table XVI, determine distance of flash unit from subject in order to produce desired increment.
6. Determine the exposure for flash-plus-sun from the combined light value of L plus I.

Figure 70.

Too much flash blackens the background.

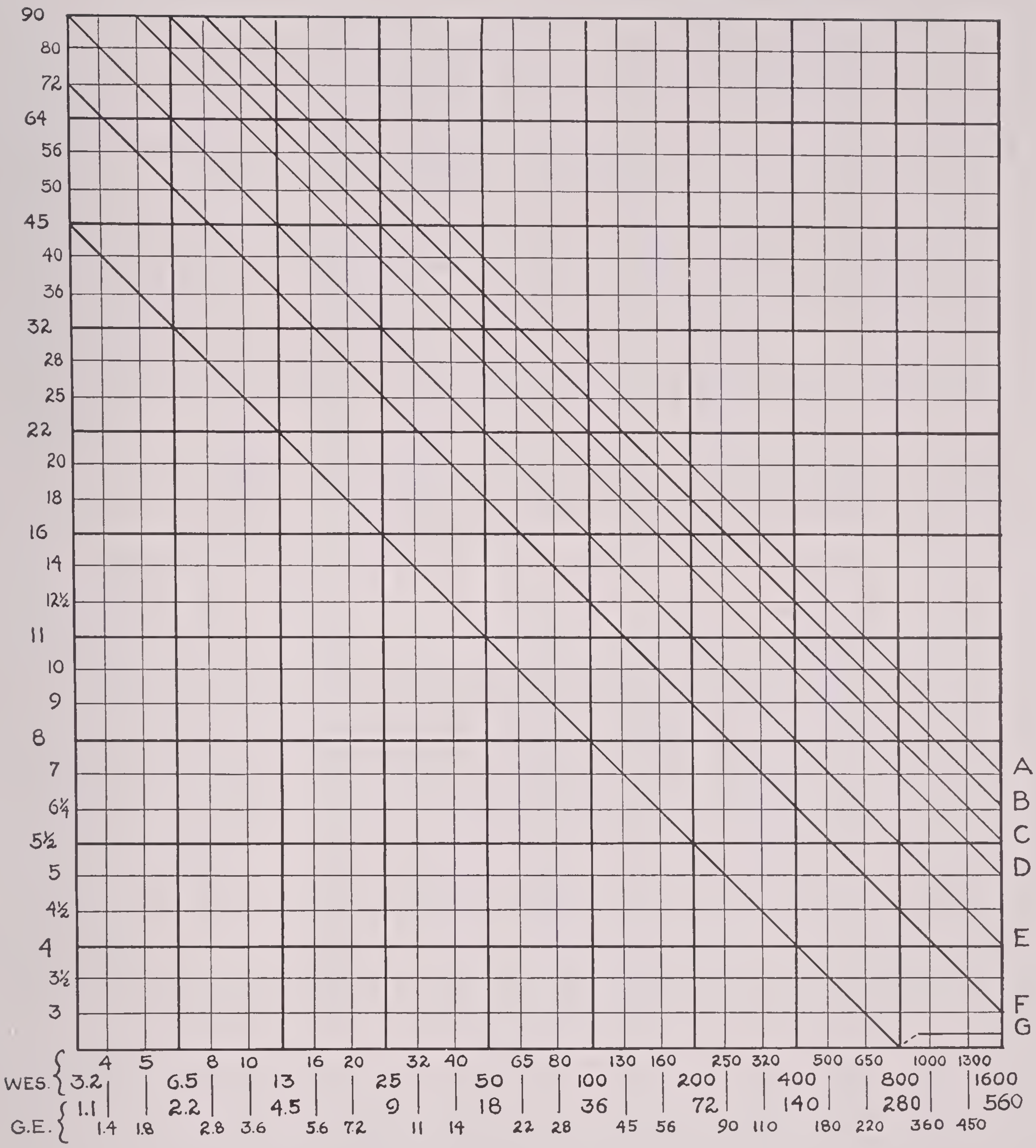
Flash on the Loose.

Though the sun-plus-flash combination has been with us only a few years, its misuses and excesses are already well standardized. Brief mention will serve to identify and explain most of them.

1. *Face over-lighted.* Not uncommon are sun-plus-flash pictures in which the model's face seems to be lit up like a Japanese lantern. (Figure 69, for instance.) It appears to be not merely illuminated, but to glow from within by some fiendish agency. This effect results from a flash unit that is much too powerful, or is brought much too close.

2. *Background or sky too dark.* This error (Figure 70) invariably goes along with the preceding one. If the face is over-illuminated, the sky or other background becomes under-exposed and appears extremely dark. This effect is sometimes advanced as one of the advantages of flash, since sky tone may thereby be darkened without use of filter and its accompanying color distortions. But this is an effect that should be employed with discretion, since it looks ridiculously grim and melodramatic with ordinary subject matter—as if one should try to do a spring dance to "The Ride of

Table XVI



Key to Table XVI.

Line A. G.E. 21; Wabash 2.

Line B. G.E. 16A.

Line C. G.E. 5 (special reflector)

Line D. Wabash 40, Wabash 25 (special reflector)

Line E. G.E. 31 (focal plane); G.E. 5 (regular reflector)

Line F. G.E. SM (special reflector); Wabash 0; Wabash 25 (regular reflector); Wabash 2A (focal plane)

Line G. G.E. SM (regular reflector)

Procedure: Take meter readings. Note ratio of S:L, and from Table XV, determine the increment required to produce an S:L ratio of 1:4. Find this increment on base line of chart. Follow up the vertical line corresponding to increment until it intersects the diagonal line corresponding to your bulb. Opposite this point, on left side of chart, will be found the distance (in feet) at which bulb should be placed from the subject.

the Valkyries." So pronounced an effect as this is worth saving for use with appropriate subject matter. See Figures 71 and 72.

3. *Inconsistent Shadows.* When there is lack of balance in the sun-flash set-up, there is almost certain to be inconsistency in the shadows. At the worst, there will be two separate sets of shadows in the face, betraying light from two sources. Or the shadows in the face will go one direction, those in the background, the other. A less serious discrepancy appears when shadows fail to match in density. In Figure 74, for example, the shadows on the face are considerably softened by the fill-in flash. The model's shadow on the sand, being on a receding plane, is less affected by the flash, therefore appears perceptibly darker.

4. *Illogical in general.* Inconsistency of shadows is really a special case of bad logic in the use of sun-plus-flash. But the very nature of the flash renders it prone to illogicalities. The flash bulb, in short, enables one to bring startling illumination into places where the very logic of things demands that the lighting be subdued.

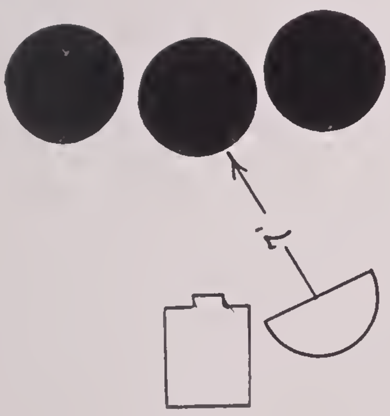
A well-known early example of synchro-sunlight photography shows two children walking through the woods. In this place of subdued light and soft shadows, they are suddenly transfixed by a blast of light from nowhere in particular, a light of which it may be truly said that it "never was on land or sea." It is an excellent background, it is a charming picture of the children, but the lighting just doesn't make sense.

5. *Main source and fill-in too nearly equal.* We have suggested 1:4 as the best all-round value for the ratio S:L. There may be occasions when, with a very soft and non-committal background, or with mere sky as a background, it is justifiable to reduce this ratio to as low as 1:2. Lower ratios than this are liable to introduce illogical and equivocal effects, with darkened skies and background shadows more strongly marked than those of the subject.

Theoretically, the system of "common increments" operates along the lines of the classic instance of Achilles and the tortoise, with the shadow area (S + I) always approaching, but never quite catching up with, the light area (L + I). But in actual practice, it doesn't work out that way; for darkened skies and illogically directed

Figure 71.

Figure 72.



Figures 71 and 72. "The Three Witches," showing the use of flash to neutralize sunlight and blot out the background.

Figure 73. *Figure 74.*

Flash may produce discrepancy in shadows. Compare in Figure 74, the density of shadows on the model's throat and on the sand.

shadows immediately betray the moment when the fill-in light begins to usurp the prerogatives of the main source.

6. *Main source and fill-in too widely separated.* Sixty degrees has been suggested as the widest permissible separation between fill-in and main source. Wider angles than this incur the danger of losing the desirable *merged* illumination of the subject. (Figure 53.) Any greater angle is apt to produce an artificial type of lighting. Wider separation still may produce an actual zone of shadow between the two zones of light—a generally ridiculous and illogical effect.

7. *Smacks and smears of light.* Much esteemed by some who have learned about lighting in the studio, instead of looking at what the sun had to offer, is the sort of illumination shown in Figure 76. Here are patches of light exploding where they mean less than nothing, gobs of light entangled in the hair and dripping over the ear like a campaign tomato. Of course, the fill-in has been brought much too close to the subject and has been concentrated into too narrow a beam. Obviously, also, the fill-in is operating at an angle too wide from the direction of the main source.

Figure 75.

Figure 76.

Smacks and smears of light induced by flash unit too close and too concentrated.

The Sun as Second Fiddle.

In all the examples so far considered, the subject has been placed in the direct sunlight, which has in all cases served as the principal source of illumination. The flash has acted merely as a fill-in to balance the brightness of light and shadow areas in the face of the subject.

There are only a few cases in which, with the subject in direct sunlight, the flash may justifiably be promoted to the position of principal source. One of them is the example already mentioned, *The Three Witches* (Figure 72), wherein the emphasis is on the sheer melodramatic effect of the darkened sky and irregular angle of illumination.

A less strained example of the subordination of sun to flash occurs in Figure 77. Here was a complexity of circumstances. The sun was low and clear, nearly setting. This flat angle of the sun produces a

Figure 77.

Flash as main source, sun as fill-in.

very ugly illumination if the subject faces it. However, only by facing it could the desired background be used. Altogether, it was a typical photographer's dilemma. So the flat-angled sun was relegated to the position of fill-in, while the flash unit, operating at an angle of about 45 degrees to the sun, was brought in close enough to serve as the main source, with an illumination about three times greater than the sun.

Flash in the Shade.

However, the principal use of flash dominant over the sun occurs in cases away from the direct daylight. Under the eaves of the porch, in cloisters, or indoors during the day, it may be necessary to use the flash as the main source. In cases such as these, the main issue is *speed,* since the lighting under these conditions is usually very soft.

Care must be taken that the flash does not swamp this soft interior illumination. For the general set-up, we follow the ideas we outlined in the first part of this chapter, simply bearing in mind that the

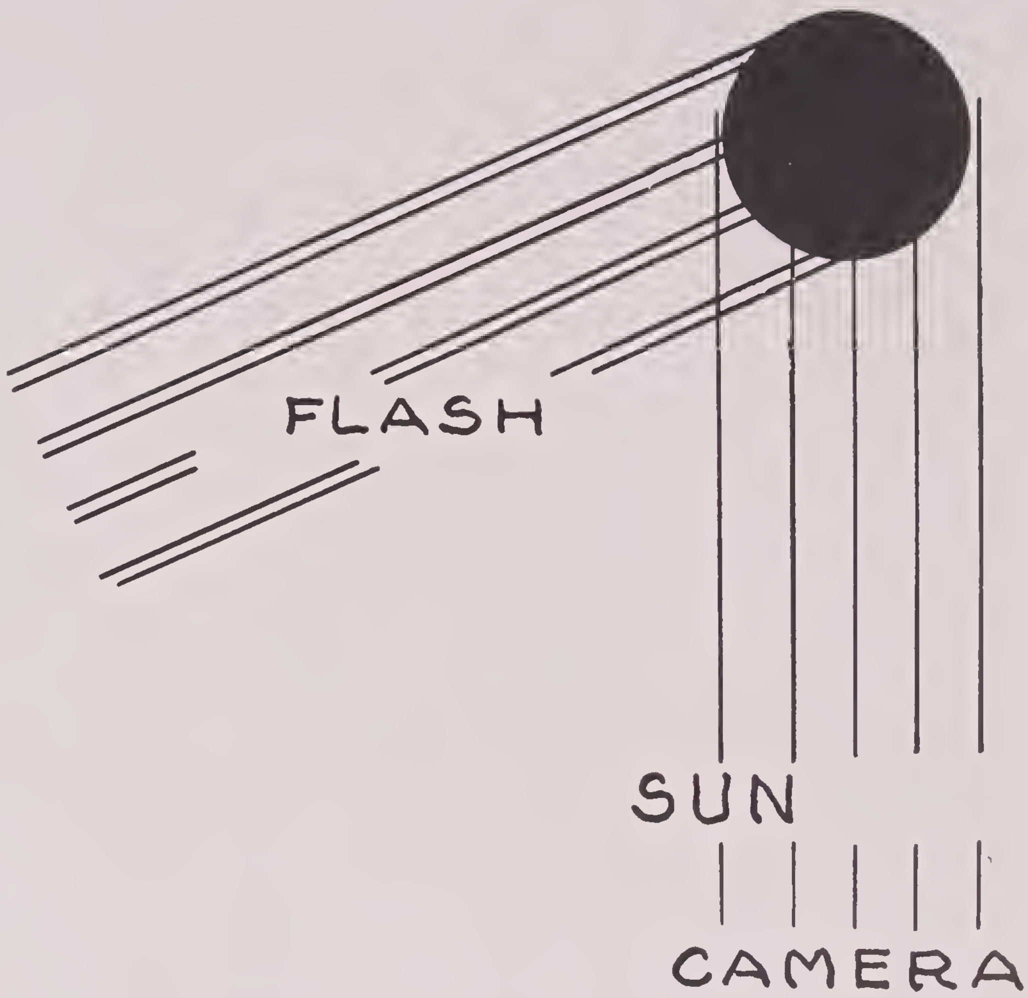


Figure 78.

Set-up combining flash with indirect daylight indoors.

sun-source and flash-source are reversed in position as well as in function. The basic set-up becomes that of Figure 78, which should be compared with Figure 53.

Since the daylight is now serving as the fill-in, it should be directed approximately along the axis of the camera. The daylight in these circumstances is not strongly directional, so you actually have considerable latitude in the choice of camera angle. The flash, now functioning as principal source, should in most cases be separated about 45 degrees from the camera axis.

The question of comparative light values and the S:L ratio takes a different form under these conditions. In the final picture, the light reading L is going to serve as the shadow value. Consequently, S, the actual shadow reading is disregarded.

However, we still wish to produce, in the *final* result, the S:L ratio of 1:4. Once more the problem resolves itself to the determination of the proper "increment" to produce this ratio. We must find an amount of light which, added to the daylight reading, will produce an illumination four times as bright. Putting the problem, as before, into equation form, we get

$$\frac{L}{L + I} = \frac{1}{4}$$

Which resolves itself to the simple formula

$$I = 3L$$

(in which L is the light reading and I is the increment that must be supplied by the flash).

Let us again take a concrete instance. The meter reading in our sheltered situation is 13 for the light area. By the formula above, we know that we must have an increment of 3L or 39 in order to produce a 1:4 balance in the result.

Suppose that we are using a Wabash 25 or 0 bulb. Look in Table XVI. In this case, it indicates a distance of 20 feet for the Wabash 25 or 0 to deliver the desired increment of 39.

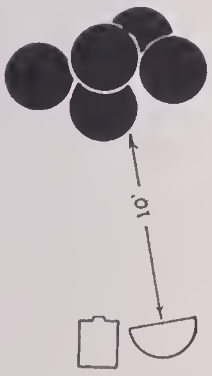
The exposure is based on the ultimate light value or L + I, which equals approximately 50. Figure the exposure on this value, using the tungsten rating for the film, since the flash functions as the principal source. If we were using A film and shooting at 1/200, the indicated F: value for the set-up under consideration would be F: 4.5.

Summary of procedure for Dominant Flash.

For shooting under conditions in which the flash must be the dominant source, the procedure may be thus summarized:

1. Let the daylight be directed approximately along the axis of the camera.
2. Separate the flash unit about 45 degrees from the axis.
3. Take the meter reading in the light-area (L) of the subject.
4. Determine the necessary increment, which is three times this reading (3L).
5. From Table XVI, determine distance of given flash unit which will produce this increment.
6. Base exposure on value of four times the reading for light-area (4L). Use the tungsten film ratings.

We shall have more to say about this procedure in the next chapter. Many architectural details and interiors must be shot under similar lighting conditions.



"Pelecani Occidentales" *Roland Beers*

Figure 79. Prize-winner in Graflex Golden Anniversary Picture Contest. Data: 4x5 Speed Graphic, 1/100 at F:22. One medium sized flash bulb, sun as backlight.

Chapter Four

Landscape and Architecture

Conventional applications of the flash have led us to associate its use primarily with the photographic quest for *speed,* with impatient or fidgety subjects in an inadequate light.

Yet, curiously enough, one of the most interesting uses of flash is found in a field where the subject matter can never be called impatient or uncooperative. Landscapes and old houses are the favorite material of many photographers because they do not demand the hectic collaboration of uncertain human factors: they are simply *there,* and wait patiently through the years for you to seek them out.

But when you attain the mature viewpoint that brings increased appreciation of such things, you find yourself, all too often, despite your experience, in the familiar predicament of the amateur: you see one thing, your camera sees another. What seemed to be a charming bit of countryside your camera declares to be cluttered and uninteresting. At the same time, this allegedly veracious instrument points out that the quaint old house that you so admired is extremely crass and commonplace.

In this case, even as with the sentimental records which we mentioned in the first chapter, the flash proves of genuine value to the photographer in helping him to realize, in his picture, that which his eye sees.

Landscape as Portraiture.

What do we mean by a landscape? Since landscapes are under consideration, it might be a good idea to find out before we go any further.

Good photographic landscapes are rare, much rarer than good portraits. This is due, in part at least, to lack of understanding as to what constitutes a landscape.

If we put someone in front of a camera and proceed forthwith to take photographs of him, there is a reasonable chance that we might get a portrait of him. But if we take our camera out-doors and shoot at random, the chances of our getting a landscape are about equal to those of my being struck down by a meteorite as I write this.

Landscape, I believe, is best understood as *a sort of portraiture.* In other words, every good landscape must feature some single *leading character.* So it is just as futile to try to make a landscape of the Grand Canyon as it is to try to make a portrait of the crowd on the beach at Coney on a hot Sunday.

Study of good landscapes will reveal that they are essentially *portraits* of trees, of rocks, of streams, of small buildings, of corners of large ones, of various nooks and crannies and intimate aspects of individual items in the world about us. Before shooting a landscape, be sure that it contains some portrait element.

1:4 in Landscape.

In the last chapter we pointed out the importance of the 1:4 ratio in out-door portraiture. This 1:4 ratio, you will remember, applied not to the total range exhibited in the picture, but to the range in the area of greatest interest, the subject's face. Similarly, in landscape or architectural material, the ratio should be about 1:4 in the single element of greatest interest, that which we have not too fancifully designated as the "portrait element" in the picture.*

Note, in Figure 81, how the picture is improved, and how the tree gains in importance as the "principal character" by the introduction

* The use of the 1:4 ratio, it must be remembered, is postulated upon adherence to the 7-D negative procedure.

Figure 80.

of the 1:4 ratio in rendering it. Even the humble structure in Figure 83 is given a bit more dignity by improved light balance.

Flash and Landscape.

Heretofore, the amateur who realized the need sometimes of light control in landscape shots had no means of realizing it. Obviously, it was impracticable to set up a reflector to illuminate a tree or the whole side of a house. On movie locations, when contrasts are too heavy, light men bring a few sun arcs to bear on the situation. Now the amateur with a couple of flash bulbs in his pocket has equivalent command over recalcitrant lighting conditions.

Balancing the Foreground.

Figure 80 is an example of this sort of thing that pleases the eye but does not make a good landscape. The jagged contours of the old tree is full of character. Here is an excellent subject for a good piece of landscape "portraiture." The stormy formation of the clouds is also important as a background.

But when we try to make the picture, we immediately run into the ancient bane of the photographer—more contrast than his medium can handle. There is too wide a difference between the

"Oak Branch" *William Mortensen*

Figure 81. Flash is necessary in this case to lift the illumination of the "portrait element" of the picture, while still holding the detail in the sky. Exposing for the sky, without flash, as in Figure 80, results in a mere silhouette. Had one exposed for the foreground, sky detail would have been lost.

Figure 82.

Figure 83.

"Pour les Dames"

Original S:L ratio 50:400. Raised to a 1:4 relationship by Wabash "25" at 16 feet.

luminosity of the sky and that of the tree for the film adequately to record them at the same time. The contrast, the S:L ratio, according to the meter, is about 1:32. If you lengthen your exposure so as to include some of the characteristic detail of the branch, you blank out your sky completely. And if you concentrate on getting the right exposure for the clouds, the branch becomes a mere silhouette. But the point of the picture depends upon getting both things, tree and clouds; either without the other is uninteresting.

Flash offers the only reasonable method for balancing these divergent luminosities and bringing them down into comfortable photographic range. By means of meter reading and Table XV, a proper increment is determined to light the tree a bit brighter than the clouds. This necessitates bringing the flash unit quite close in. (Figure 81.)

A similar problem would have been presented if, instead of

Figure 84. Rendition of foliage improved by use of flash.

clouds, the background had consisted of distant sun-lit hills. Here again is a discrepancy in the brightness of foreground and background, not to be reconciled by ordinary photographic means. A judicious use of flash would put enough luminosity into the foreground tree to make an easily handled 1:4 relationship with the hills. In this way, the tree would gain interesting detail, but would still remain sensibly darker than the background.

Flash and Foliage.

So far, in dealing with the use of flash in landscape, we have spoken of cases in which the principal subject was fairly close to the camera. This is necessary, of course, when any appreciable amount of *illumination* is demanded of the flash unit. Figure 84 presents a different question. The dominating mass, the nearest oak tree, is about 75 feet distant. The foliage is very dark, but we want it to represent something more than a mere black blob in the picture. It is not feasible to extend the exposure to catch more detail in the leaves, because in so doing we would over-expose the distant hills. In short, the same old predicament.

A big flash bulb (Wabash #2 or G. E. #50) solves the problem. At such a distance, its illumination is not great. But it is sufficient, in the hazy sunshine of this day, to slightly lift the tone of the dark foliage here and there, and to introduce a little vitality into what would otherwise be a dead black mass.

Figure 85.

Figure 86.

"Cloister: San Juan Capistrano." Long range illumination by one G.E. No. 5 in "rifle beam" reflector. Lens of long focal length used in Figure 86 in order to eliminate over-exposed foreground.

Corridors.

Figure 85 is representative of a common type of problem—a long narrow hall or corridor. Two things are essential: to get a long throw of the light; to avoid over-exposure of the foreground elements, with rapid falling off of the illumination.

The necessary long throw is provided by the use of a midget bulb in a "rifle beam" reflector. This type throws a concentrated beam of not more than 30 degrees spread. The danger of over-exposed foreground is met by using a lens of long focal length. By this means, the over-exposed elements are excluded from the picture area (compare areas covered in Figures 85 and 86) and the picture begins at the point where falling off ceases to be drastic. The farther away it is from the light source, the less becomes the falling-off in illumination within a given distance. (For example: at 11 feet from the source, the light has only 1/121 of the strength it had at 1 foot. But at 20 feet, it still has one-quarter the power it did at 10 feet.)

Figure 87.

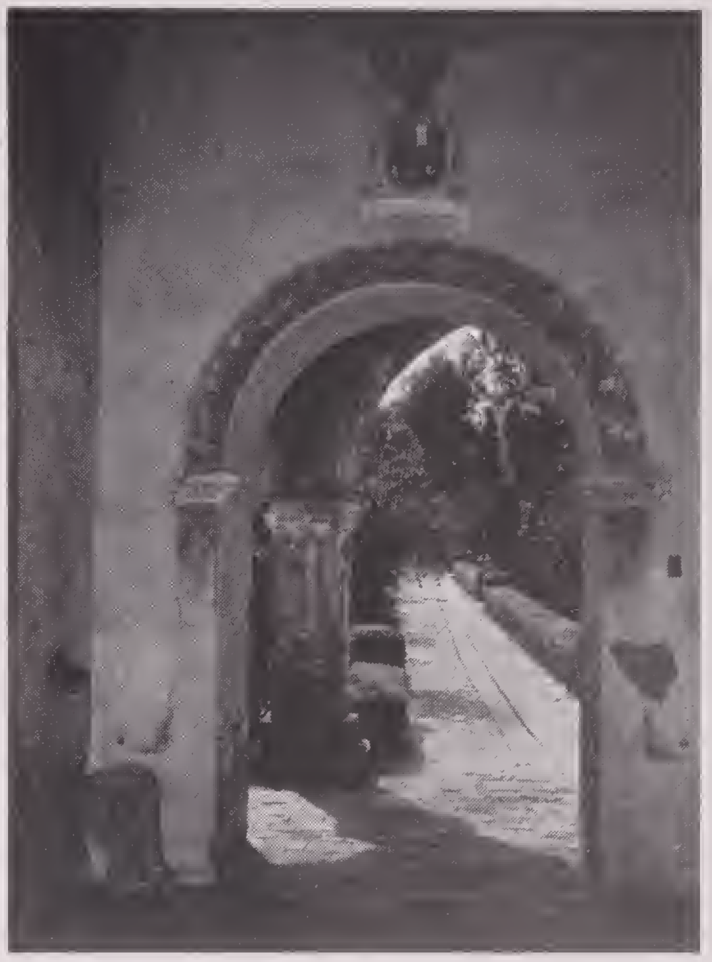


Figure 88.

1:32 ratio balanced by use of flash.

Notice that the flash is carefully subordinated: it fills in the shadows where necessary, but does not destroy the side illumination from the sun.

Against the Light.

Figures 87 and 88 demonstrate a photographic predicament readily solved by use of the flash. It is a familiar example of the old dilemma: you want to include both the interior and the exterior (more or less as your eye sees them), but you quickly discover that exposing for one area means the sacrifice of the other.

Here we wish to build up the interior detail to a reasonable relationship with the bright exterior. Too much flash in such a case, with the inside brighter than the outside, is unpleasant and illogical. A good general relationship between the two is our old

"Blacksmith Shop"

Figure 89. Small amount of flash used to make interior match shadow area across the street.

friend, the familiar 1:4 ratio. This will keep the interior detail sufficiently readable, but logically subordinated to the sunny exterior.

We require, then, from the flash, an increment of light that will raise the general inside reading (S) to one-quarter of the general reading for the exterior, (L). The amount usually can be determined without recourse to elaborate arithmetic; but, just for the record, the formula in this case is:

Figure 90.

Figure 91.

Violent contrast as a result of sky reflection being cut by overhanging branches. S:L ratio of 13:400, or 1:32. Approximately 1:4 ratio in Figure 91 with one Wabash 2A bulb at 11 feet.

$$I = \frac{L}{4} - S.$$

The effect of the flash on the exterior under these conditions is, of course, negligible.

In the instance of Figure 88, the S:L ratio between the dark interior and the general exterior was 6.5:200, a ratio of 1:32. We want an increment that will build up the interior illumination to about one-quarter of the exterior. This means an increment of about 40, since 46.5:200 is approximately 1:4. (The increment in cases of this type affects the S reading only.) For an increment of 40, following Table XVI, we use a Wabash "25" at 20 feet, or a G. E. 5 in regular reflector at 25 feet, from the arch.

Supplementary Notes

on

Professional Flash

Don M. Paul

Introduction to Professional Flash

The press deserves a credit line for its acceptance of flash at a time when it was still an untried, unproved experiment, and for its peristence in the development of flash technique since then. Since 1930, almost every major development in synchronized flash has been due to the perseverance of newspaper men who have put in a plug for it on all occasions, and have hastened its acceptance by means of homemade equipment which soon became standard, and through revolutionary usages which eventually became regular procedure. Thanks to the newsmen, flash has become indispensable. It has occasioned new trends in photography, it is the basis of a new kind of journalism.

William Mortensen has presented the case of the pictorialist and has, I believe, given us a widened outlook on the potentialities of flash. It is characteristic of the pictorialist that he works with a certain degree of deliberation, molding and shaping his subject matter to order, and then photographing it according to plan. Quite different is the case of the "spot" photographer who is confronted by subject matter which he must photograph on the spur of the moment, without opportunity to plan his shot or arrange his material. Obviously, this situation requires a different technique, direct and simple.

This professional section deals mostly with "spot" photographers, the barriers that confront them, and the devices used to surmount them in the quest for picture material. We find spot photographers in many trades—on newspapers, in movie still departments, on police forces, in hospitals, in aircraft factories, in radio studios, in any field where publicity, documentation, or news is concerned.

In most cases the technicalities involved in the use of flash are similar, yet the circumstances involved in procuring pictures differ radically. Each of these fields is highly specialized, with the photographers in them trained in the applicable fundamentals.

These differences are our concern now. William Mortensen, through his experiments, has illustrated excellently how the pictorial artist can benefit by the use of flash. He has outlined the basis on which good flash pictures can be taken. Now, by applying these principles to other fields, keeping in mind that each field plays its part in the daily scene, you will see how varied are the applications of flash photography.

To the experts who have assisted in the compilation of this section, my sincere thanks.

Don M. Paul

Hollywood, California.

Documentary Photography

It would be difficult to imagine a major field of photographic endeavor which has benefited more directly from the advent of the flash bulb than has the documentary. The documentary photographer sets out to record life, as it is really lived, and in order to do that he must be able to get a well lighted, fully exposed picture under every conceivable condition. No such freedom from photographic limitations was possible until the flash bulb came along bringing not only complete freedom but a vast extension of possible photographic activities.

It is universally acknowledged that by far the finest and most extensive job of photographic documentation is that which is being carried out by the Farm Security Administration under the direction of Roy Stryker. In fact the contribution of Mr. Stryker and his group of expert photographers has been so outstanding that the phrase "F.S.A. Photography" has come to have more meaning for many than the word "documentary" which is intended to describe it.

Mr. Stryker has this to say about the application of flash to F.S.A. Photography:

"The F.S.A. photographer's camera is a recording device intended to register the pulse, temperature, vitality, complexion, nerve-tension, and the Bertillon measurements of contemporary America. His flash gun is useful to him in the exact degree in which it helps him in this recording job. He may shoot flat flash or multiple flash according to the particular requirements of light, subject matter and the story which must be told. Generally speaking, these requirements fall into the following categories:

"Last Minute Instructions" *Lee (F.S.A.)*

Figure 92. High school basketball game, Enfaula, Oklahoma, Feb. 1940. A fine action shot by F.S.A.

1. The recording of fast action in poor light. (Figures 92, 93.)

2. The bringing out of a maximum of factual detail in places where adequate natural or electric light sources are not available. (Figures 94, 95, 96.)

3. The re-creation of the 'mood' of existing light by its duplication with multiple flash, thus eliminating long exposure and guaranteeing a maximum focal depth. (Figures 97, 98, 99.)

4. The use of multiple flash for explanatory purposes, as, for instance, in the case of machinery in a textile plant, which requires the correct interpretation of planes in depth; these would be flattened out with a single bulb on the gun. (Figures 99, 100.)"

"Jigger at the Square Dance" *Lee (F.S.A.)*

Figure 93. Action—and how. One of the famous Pie Town series.

"Mother and Son at Pie Supper" *Lee (F.S.A.)*

Figure 94. This shot, from Muskogee County, Oklahoma, shows the facility of the flash in completely factual portraiture.

"Memphis Stock Exchange" *Marion Post-Walcott (F.S.A.)*

Figure 95. Full factual detail under poor lighting conditions.

"We may not have much of a house here, but we will have one in Heaven."
Community Camp, Oklahoma City.

Figure 96. Lee (F.S.A.)

"Having a Beer at Art's" *Delano (F.S.A.)*

Figure 97. A rainy day in Colchester, Connecticut. A beautiful piece of flash photography, accurately recreating the mood of the existing light.

"Day Nursery" *Rothstein (F.S.A.)*

Figure 98. Children in nursery, Tulare Migrant Camp, Visalia, California. Finely balanced illumination.

"Family Group" *Delano (F.S.A.)*

Figure 99. Ten people live in this shack. They must move to make way for army maneuver grounds. Caroline County, Virginia, June 1941. Interior illumination is a little too bright for strict accuracy, but it produces a beautifully stylized result.

"Mill Worker" *Delano (F.S.A.)*

Figure 100. Girl worker at the Penemah Mills, Taftville, Connecticut. Note use of flash for correct interpretation of receding planes in machinery.

Press Photography

Newspapers, in the last ten years, have outgrown their swaddling clothes of centuries, and have radically changed format. The transition continues. Straight journalism has found its equal in pictures, and the newsphoto has finally gained recognition as a vehicle of journalism in its own right.

Today a picture of a vital news event travels by wire or radio across a country, a continent, or a hemisphere, and an hour later appears in print in a distant paper. An average large city daily contains forty or fifty pictures. The single photographer who, ten years ago, took the few necessary pictures for his paper, now heads a staff of ten or more photographers. Picture magazines have sprung into prominence, and the disfavor that was once directed at the tabloid has disappeared because almost every newspaper, willingly or not, has followed the tabloid trend.

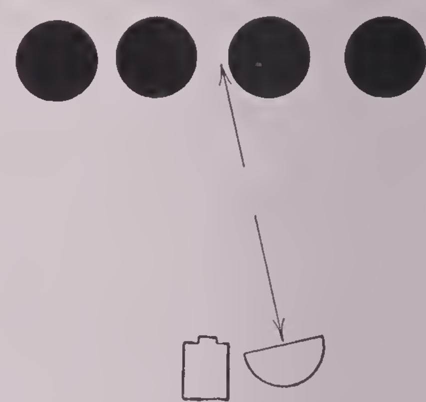
The public wants pictures. It is interested in seeing as well as in reading about events that affect its life and living. A picture is a good substitute for actual vision. The adage about a picture being worth 10,000 words has been acted upon.

This change was caused by radical improvement of photographic equipment, hastened by the development of the flashbulb. As soon as the flashbulb had proved acceptable, the growth in pictorial emphasis in journalism was noted—particularly in that type of picture which was rarely attainable before—the candid, real life, action picture taken at the scene of the news.

"The News" *William Land*

Figure 101. Prize-winner in Graflex Golden Anniversary Contest.

Data: $3\frac{1}{4}$x$4\frac{1}{4}$ Speed Graphic, 1/100 second at F:32, one G.E. No. 21 placed as shown in diagram.



Today, with news photographs an accepted part of journalism, picture editors pay a great deal of attention to their presentation. Picture pages are balanced for easy seeing, easy understanding, and human appeal. Assignments are planned, and although news-breaks that come spontaneously often determine the nature of pictures used, still a certain design is followed in balancing newsphoto content in a paper.

There are two general types of newspictures: the spot picture, and the planned picture. Spot pictures, of course, are those which suddenly arise through some vital occurrence, permitting the photographer only one chance at immortality. "Bunny Howard's Story,"

"Senator George Speaks" *Edward I. Bernd*

Figure 101. Prize Winner in Graflex Golden Anniversary Contest.

Data: 4x5 Speed Graphic, 1/1000 second at F:16. One Wabash Press-40 to illuminate figures in shadow.

This delightful political commentary, needless to say, was unposed.

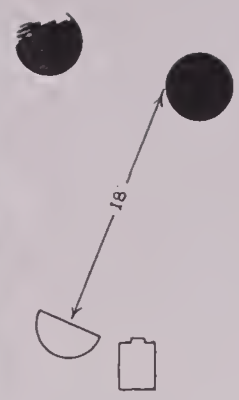


Figure 103.

"Bunny Howard's Story"

Clarence Albers, N.Y. Journal-American

Data: 4x5 Speed Graphic with Mendelsohn synchronizer, 1/200 second at F:11 on ortho. One Wabash Press-40 on camera. This spot picture had national coverage. Action occurred after court trial in which judge granted wife custody of child. Husband, heartbroken, struck down wife and snatched child. Press photographer, anticipating picture, was ready for it.

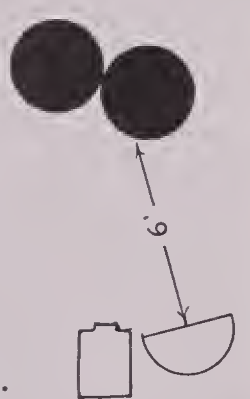


Figure 104.

"A Prayer for a Miracle"

J. H. McCrory, Los Angeles Times

Data: 4x5 Speed Graphic with Mendelsohn synchronizer, 1/200 second at F:22 on Agfa Plenachrome Press. One Wabash Press-40.

This was a front-page news picture that has won several prizes. The subject offers a grief-stricken prayer before a statue of a patron saint while her little daughter, one of her children from whom she will be separated by deportation, sobs at her shoulder.

"Orthopedic Hospital" Hansel Meith

Figure 105. This well-known flash shot was made in the Children's Hospital—Orthopedic Division—Lincoln, Nebraska. (Courtesy of Life Magazine.)

by Clarence Albers (Figure 103), is a good example of this type of picture. The planned picture is explained by its title. Although it too may be limited by time or circumstances the photographer ingeniously manages to plan his angles. George Lacks' "Bomb Raid" (Figure 111) and J. H. McCrory's "Prayer for a Miracle" (Figure 104) are good examples.

To further round out these classifications, we find that subject material in newsphotos falls into four groupings: Existence, Success, Diversion and Sex. Under the first grouping come those pictures which, for news content, materially affect the reader, either directly or indirectly: local catastrophes or international wars, political or economic events; births and deaths. The Success type of picture is that which glorifies the accomplishments of man or mankind. The Diversion picture is that which is intended to distract the attention of the reader from the monotony of his existence. Under Sex pictures will be found those which relate to marital ties or their dissolving; sin; in some cases, crime; in all cases, "cheesecake" or leg-art which displays the charms of women.

Where the portrait artist is permitted time to experiment in his work, the press photographer is not. His experimenting must be extra-curricular, and on the job his picture taking must be confined to news. He must record an image on every piece of film, and each image must be pertinent to his work. Above all, knowing that he may be permitted by circumstances to take only one picture of an event, that one picture must be perfect on the first try. (Oftimes he must work hurriedly, or in the dark, where his reflexes dictate his activities.) That makes it compulsory that he know his equipment intimately, that he be familiar with the limitations of his camera, his film and his flashbulbs.

Camera equipment for press work changes with the times. Makes of synchronizers vary with the locality, service being the principal factor that determines the make. It is generally conceded, though, that the type in which the tripper is permanently mounted on the lensboard is the most efficient, as it is least liable to go out of synchronization.

Wherever circumstances permit, a tripod is used, often for se-

"Texas Cowboy" Hansel Meith

Figure 106. Flash unit ingeniously placed to keep light off of foreground. (Courtesy of Life Magazine.)

Figure 107.

"The New Models" Otto Hagel

Courtesy, Time, Inc.

curity and stability, often to permit the use of extensions for side or backlighting.

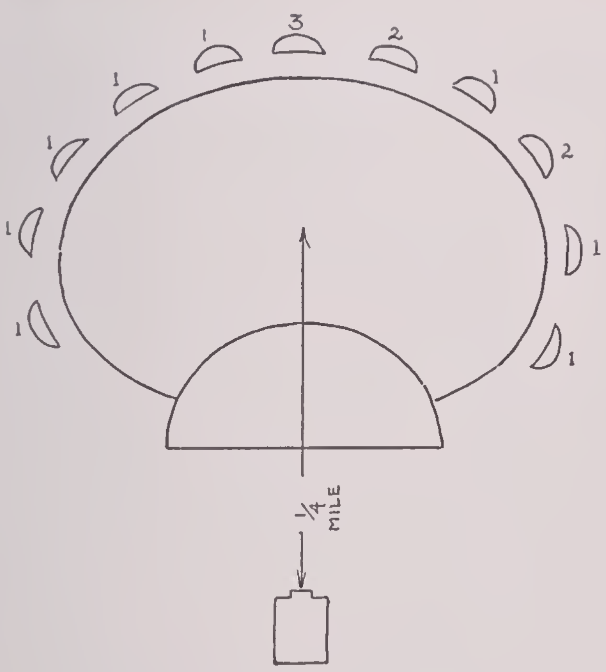
The midget bulb has gained some acceptance because of specially designed reflectors that permit diffusion to cover small areas, or the concentrating of a beam of light over a distance. The principal advantage found in the midget bulb is the convenience in carrying a quantity. Nevertheless, the majority of press photographers continue to use larger bulbs, particularly because they want to be equipped to cover large areas should the occasion arise. In this they are limited in using the midget bulb, as concentration of the beam permits covering a small area over a great distance, but often with a spot.

The greatest interest in photographic trends is manifested by press photographers. Just as the acceptance and gradual increase in efficiency of the flashbulb is credited to the press, so can considerable credit go to them for developments in synchronizers, synchronization testing equipment, fast film, and durable cameras. Many devices for which the news photographer served as guinea-pig have passed on to photography generally. The use of flash in tandem or multiple arrangement is one development that is now generally accepted.

If time and circumstance permit him to do so, he always uses a second bulb on an extension for highlighting and modelling.

An extreme case of multiple flash is the well-known picture of the Hollywood Bowl by Otto Rothschild. (Figure 108.) As shown in the accompanying diagram, fifteen flashbulbs on a huge extension were fired at one time by a tripper on the camera. Several different ways of accomplishing this shot were tried, with nearly identical results. On one occasion, fifteen assistants posted about the bowl fired their individual flash bulbs in unison when given the signal over the loud speaker system.

The exposure data recommended by manufacturers of flashbulbs is generally accepted with important reservations. As that data applies to normal surroundings, and as it may be said that nothing is normal in press photography, the cameraman must determine the deviations required when shooting outdoors in total darkness, or in a room where reflective surfaces and white walls increase the benefit



"Hollywood Bowl" *Otto Rothschild*

Figure 108. Data: 4x5 Speed Graphic with Heiland Sol synchronizer. Shot "open and shut" at F:4.5 on Agfa Superpan Press. 15 Wabash No. 2 arranged as shown in diagram. Concerning this unusual shot, Rothschild says: "I have made this picture several times without flash but the shadow areas, those not affected by the house lights, were always too black. This picture was made to retain the atmosphere of the lighting at Hollywood Bowl, and the flash bulbs were used to throw some light into the dark areas."

of the flashbulb. He bases this new exposure data on his experiments, using the manufacturers' recommendations as a basis for his tests. In time he is so completely familiar with exposure that he automatically makes adjustments for each picture. He favors the "flash number" idea, a value which, when divided by the flash distance from the subject, gives the proper aperture setting. (See pages 44 to 49 for details of this system.)

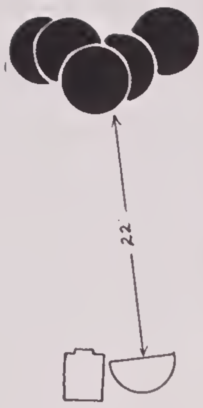
When photographing individuals with one bulb on the camera, he tries, if he can, to get his subjects to stand close enough to a neutral background to bring out strong relief, yet not much closer than their height, so that large black shadows can be avoided.

It will be noticed that the press photographer uses flash whenever he takes a picture, whether by night or day. It has long been known that flash in press use, will eliminate shadows, such as those caused by hats when the sun is directly overhead. This results in sharp, bright pictures.

With flash, which is the press photographer's principal light medium, unusual results can be had with a little imagination and planning. Sometimes he takes advantage of circumstances to *use* flash rather than let flash use him. If, on a society assignment he is asked to wait in the butler's pantry until he is called, he can repay his hostess in kind by showing every one of her double chins through unflattering placement of light and camera.

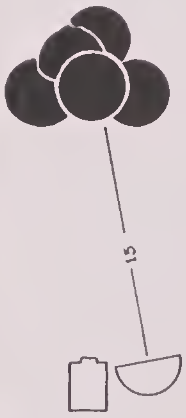
Although the pioneers of press photography have, in most cases, held the edge on newcomers, many interesting cases of youthful success can be held up as examples. One amateur, by winning several contests held by photographic magazines, found himself a professor of photography at a leading university at the age of twenty-one. Those prize-winning pictures, incidentally, were taken with flash.

Some of the best pictures ever published come from free-lance contributors and amateurs with enough news sense to evaluate and photograph an important event. Despite the capable staffs that newspapers maintain, hundreds of thousands of "string correspondents" find steady revenue in submitting pictures to local papers and national newsphoto agencies. In a recent instance, a free-lance, happening to be on the scene of a shooting on an important street



"Tangle" C. O. Schlaver,
City Editor,
Kewanee Star-Courier

Figure 109. Data: 4 x 5 Speed Graphic with Kalart Senior synchronizer, 1/200 at F:11 on Agfa Superpan Press.



"Touchdown"
Bob Handsaker,
Sacramento Bee

Figure 110. Data: 4x5 Speed Graphic with home-made flashgun, 1/900 second at F:8 on Agfa SSS. One Wabash 2A. Flash served as main source, since stadium lights would not register at this speed.

in New York, took a series of pictures which were sold for a high price to such an agency, with publication all over the country.

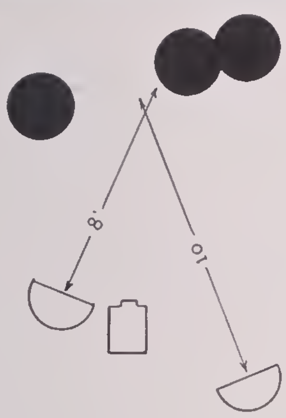
The diplomatic press photographer can and often does make a career for himself that offers countless possibilities in his old age. Many have elevated themselves to important editorial positions on magazine staffs. Many have obtained technical positions in photographic manufacturing plants. Some have specialized in phases of portraiture. Some have gotten into the movie still departments. Some have propelled their papers and their own positions by making their paper foremost photographically.

Foreign Press Photography.

Imagine being confronted with the picture of the year, shooting forty-six flashbulbs and wasting forty-six frames of Leica film to get one usable picture. That is one experience that George M. Lacks can tell about. George was stationed at Shanghai, China, for many years, syndicating his pictures throughout the world. Life, for many years was pretty peaceful, with only an occasional warlord to upset the routine of living. Then came the Japanese invasion of China, and the pace became faster.

Japanese flashbulbs were the only ones available in Shanghai, with the exception of a few made in Europe, but all were in the same category. They were foil-filled, very fragile, and utterly unreliable. The peaks varied as widely as those of the very first American flashbulbs. They would go off before the shutter, after the shutter, and sometimes, like a delayed action bomb—seconds later.

Once George was extended a privilege which he had been striving for years to get—that of photographing a famous warlord who had previously refused to be photographed. Carefully Lacks planned his shot, focused, put in a bulb, then "Bang!"—the bulb exploded with a loud report—sentries and bodyguards ran in from all points —George felt bayonets pricking his skin on all sides, rough hands grabbed him and hustled him out. A short time afterward the cause of the confusion was discovered and after the warlord was thoroughly convinced that Lacks wasn't trying to assassinate him he posed for forty-five more pictures, almost all of which were blanks because of the varied firing times of the bulbs. George did get a



"Air Raid in Asia" *George Lacks*

Figure 111. Data: Leica with Leitz synchronizer, 1/200 second at F:4.5 on Super X. Two medium bulbs diffused with handkerchiefs. Lacks comments: "This is what was left of a family of refugees which were bombed out of their hut in Kiangwan during a Japanese air-raid. Father and three other children were killed. Youngest boy in picture (leaning against his brother) is blinded." This shot was widely used by Red Cross.

couple of good pictures though, which made publications from Shanghai to New York over his credit line.

During his many years in China, George had many pictorial scoops. He not only free-lanced for all four English language papers in Shanghai, but was regularly sent on assignment by AP, NEA, INS and Wide World. In 1937 he accompanied the Chinese Government's delegation to the Coronation of King George VI as its official photographer. He covered Europe, photographing the Coronation, Chamberlain, Anthony Eden, Blum, Laval, Ciano, Litvinoff, and

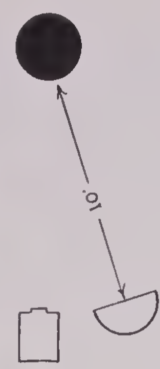


Figure 112.

"Hitler at Berchtesgaden" George Lacks
Data: Leica with Leitz synchronizer, 1/200 at F:9. One Wabash Press-40 to supplement sunlight.

This picture is a rarity, as the subject is notoriously fearful of flashbulbs. George Lacks writes concerning it: "Adolf Hitler at Berchtesgaden, June 1937. One bulb was placed slightly to the right of camera to supplement sunlight striking Hitler's face from the left. He consented to pose for this shot. Just as I took it though, the sun went down. He started fidgeting, became impatient. I shot the picture anyway, and he moved away to talk with some people."

many other notables and the shot he prizes most highly (Figure 112), a rare close-up of Hitler which he took at the Fuehrer's mountain hideout in Berchtesgaden. The picture he obtained is of particular interest because it is one of very few flash shots which Hitler has permitted to be made of himself.

The American newsphotographer working in a foreign land is, of course, expected to get substantially the same general kinds of pictures as his brother at home. The great difference between working at home and abroad is revealed by such incidents as those related above. Equipment and materials are often hard to obtain; superstitions, suspicions, prejudices and censorships of all kinds make much desired shots hard to get and raise endless difficulties about their transmission once they have been obtained.

Consequently the newsphotographer on a foreign beat must know his craft thoroughly in order to turn out an acceptable job with makeshift or inferior materials; and he must exercise much diplomacy and ingenuity in threading his way through a maze of difficulties which have little or nothing to do with photography.

Blackout Flash Photography

The hope of many specialized photographers to take pictures in total darkness without visible light seems to be realized today with the development of the Blackout flashbulb. Although it has long been known that photography with the infra-red ray is possible, it was not until the war in Europe made picture taking with invisible light necessary that rapid development of present procedures was made. Today blackout photography is almost vital in many cases.

It is known that certain rays in the spectrum are invisible to the human eye. Among those rays are the ultra-violet and the infra-red. The infra-red is fundamentally a heat ray. Infra-red film, which is sensitive to the latter invisible ray, has long been used by day for extreme contrast and for cutting through haze and fog, but adapting it to use by night with black light is a new device that has gained tremendous ground in the short period of its adaptation. This is particularly true with European press photographers who are now able to take pictures in total darkness without visible light emanating from the flashbulbs used.

Aviation authorities agree that the flare of a sulphur match can be seen from an altitude of 8000 feet. Think then what a magnificent target an ordinary flashbulb would be to a bombing plane, and how thoroughly this menace has been eliminated by the development of the blackout bulb. Wherever light is prohibited, or is objectionable, pictures which would otherwise be impossible are now attainable with black light and infra-red film.

Until July, 1941, the accepted method of taking blackout pictures

Figure 113.

Figure 114.

Comparison of Panchromatic and Infra-red rendering. Figure 113 was made with one Press-40 on Superpan Press, 1/200 second at F:16; Figure 114, one Wabash black-out bulb on infra-red film, 1/50 second at F:8. Colors: dress, dark brown; bow, scarlet; eyes, blue. Figure 114 was shot in darkness, with no visible light.

was by means of the standard flashbulb covered with a deep red gelatin which absorbed most of the visible light, permitting the infra-red ray to strike the subject. This method was not fool-proof as it leaked some visible light. Then came an announcement from the research department of Wabash that a special blackout bulb had been designed for military use, and that permission had been granted for its release to press and industrial photographers who wished to experiment in pending trial blackouts that were anticipated in hundreds of cities.

Investigation of this new bulb indicates that it is actually a Superflash #2 scientifically coated with a durable filtering substance that permits only the infra-red ray to penetrate. Further investigation indicates that the infra-red ray can be propelled by proper reflection, that, like light, it casts a shadow, and that like light it can be controlled. Where circumstances permit such handling, it has been found that more than one blackout bulb can be used for modelling effects when used as side or backlight.

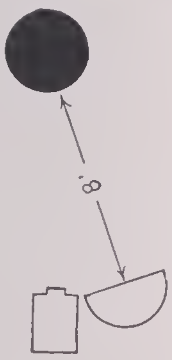


Figure 115.

"Transient"
Don Paul

Data: 4x5 Speed Graphic with Sol synchronizer, 1/50 second at F:5.6 on infra-red film. One Wabash Blackout bulb on camera. Subject was unaware that he had been photographed. Red lettering on hotel sign indicating rates as 25c and 35c disappeared under infra-red light.

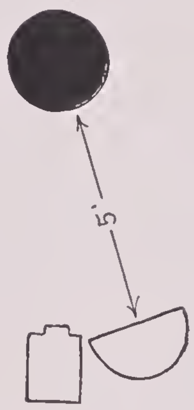


Figure 116.

"Blackout of Betty Fields"
Don Paul and Ted Allan

Data: 4x5 Speed Graphic with Sol synchronizer, 1/50 second at F:8 on infra-red film. One Wabash blackout bulb. Miss Fields was resting during rehearsal for Orson Welles' CBS radio program. She was unaware of flash. A second blackout bulb, for backlight, would have improved the set-up.

At the same time, many unusual effects have resulted, and new applications have become necessary. For instance, focusing for infra-red is different than focusing for normal film. Infra-red rays come to a focus slightly farther back. It is, therefore, necessary to rack the lens forward about 1/200th of the focal length of the lens for sharp focus. Such adjustment is hardly necessary for miniature cameras, particularly at small apertures, because of the great depth of field. Focusing through a rangefinder which is normally adjusted will result in infra-red images being slightly out of focus.

With a flat, normal type reflector, the extreme slowness of present-day infra-red film will necessitate shooting at extremely slow speeds and wide apertures. At ten feet, with a flat reflector, the recommendation is 1/50th second at F:5.6 or F:4.5. Smaller apertures are practicable with the use of concentrated types of reflectors, such as flood reflectors, or specially designed infra-red reflectors. With special reflectors it is often possible to take pictures at ten or fifteen feet at 1/50th second at F:6.3, F:8 and F:11. As in the case of ordinary light, exposures will vary with surroundings. White walls will reflect, dark walls and surroundings will absorb some of the infra-red, necessitating aperture readjustment. With smaller apertures, of course, critical focus becomes less of a problem, as increased depth of field will take care of focusing.

Although experiments show that bronzed, gilt, red dyed, or blackened reflectors cut down to a minimum the possibility of reflected visible light, standard bowl-type reflectors in addition to increasing the intensity of the infra-red ray, serve also to conceal any fractional visible flash.

It is, of course, recommended that good formulas be used in processing infra-red film; whether Eastman or Agfa formulas is immaterial. In tests which were conducted using DK-60, DK-20, ABC-Pyro, Agfa 47 and Agfa 17, as well as other developers of reputable manufacture, it was found that at proper temperatures, infra-red development requires time and a half, in other words, 50% above normal developing time. Development must be made in total darkness and fixation should actually be complete before lights are turned on.

When using cut infra-red film, holders must be completely light-tight. Holders adapted to slow standard emulsions may leak enough infra-red rays to fog the film. The type of cut-film holder suitable for infra-red is the type equipped with slides which have five little buttons on the right-hand corner of the slide.

As a general rule, faces on infra-red film are not very attractive. Strange contrasts become visible that are reminiscent of early types of standard film. Any substance that is high in red will register white. So also will dark browns and shrubbery high in chlorophyll.

Light eyes will turn black. Deep face shadows will appear. Men who seem close shaven will develop beards, as the infra-red ray seems to penetrate the skin. Veins will appear through the skin. Certain blemishes, which are not visible to the eye become perfectly obvious, as do stains in clothing which have been chemically removed, but which magically appear when photographed with infra-red. This naturally has decided advantages in certain types of work, such as police photography, and the photographing of priceless documents and works of art, where blemishes sometimes prove or disprove authenticity.

The strange results of infra-red in portraiture are shown in the accompanying examples, Figures 113-116. Comparison of the normal image with that taken with infra-red immediately indicates the surprises that infra-red can bring.

New applications have suddenly appeared. Medical men are interested in the possibilities of infra-red when it is desirable to record the very characteristics that are not compatible with portraiture. Varicose veins can now be well recorded. In oral and surgical photography, accurate records of conditions may be kept.

Newspapers are featuring pictures of theatre audiences who are unaware that they have been photographed. Pictures are being taken in courtrooms, where flash is objectionable. Even photographic burglar alarms are being devised to record an image of an intruder without his knowledge. Police are trying blackout for the collection of evidence.

Film manufacturers are reportedly working on an emulsion which will eliminate some of the unpleasant characteristics of infra-red in portraiture, and will produce an approximately panchromatic effect. Hollywood is interested in the idea since perfection of this emulsion would make possible the use of infra-red bulbs for the shooting of stills during the actual filming of motion pictures.

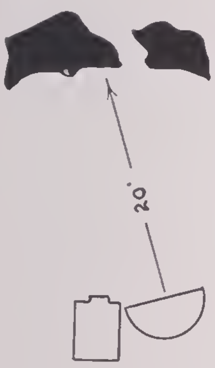
Police

A car sped down a suburban road, leaving a pedestrian lying on the street behind it. There were no witnesses. A late driver, passing by, saw a body in the road, and called the police. The victim by then was dead. If aid had been given him at the time of impact, he might have lived, but he was left to die on the road. An investigation was immediately made by a skilled crew of the Los Angeles police, but the only clues to be found were tire marks on the road and, beside the body, a radiator ornament of chrome in the shape of a girl, arms outstretched as if ready to leap. The ornament had been broken off at the ankles, apparently by the impact. Some wag in the group of investigators called it Leaping Lena, and thus was the case titled.

Pictures were taken immediately by the police of all clues. Then an exhaustive investigation was begun. The first step lay in calling upon all auto repair shops in the area. From the skid marks and the ornament, fundamental identification had begun. Then came word from a repair man of a car that had been repaired within a day since the occurrence. That car had recently lost a radiator ornament.

Officers visited the home of the owner of the repaired car, and found the car parked on the street. Leaping Lena's broken legs fitted the stumps atop the remains of the ornament. Pictures were taken of the joining. Police made the arrest. At the station, quick development of the pictures showed in sequence an officer fitting the ornament to the stumps, and the final perfected joining. Further photographs of the tires definitely matched the pictures of the skid marks. On being confronted with this evidence, the hit and run driver confessed to the crime. The pictures, on corroboration by the arresting officers served as the evidence in the courtroom which convicted the culprit.

This case is one of many that has proven to police forces all over the world that photography is vital to crime prevention and detec-



"Wreck" *Los Angeles Police Department*

Figure 117. Data: Recomar 18 with Abbey Synchronizer, 1/50 second at F:5.6 on Super Ortho Press. One G.E. No. 21.

tion. Thousands of cases can be found on the dockets that are marked "Closed" because so conclusive has the photographic evidence been that the criminal found himself and his alibis overwhelmed by self-explanatory incriminating evidence.

It is really only five years since photography has become indispensable to the police. True, cameras have been used, for possibly twenty years or more, but one point has always limited their utility—lighting conditions. With the perfecting of the flashbulb, the last obstacle to standard acceptance was eliminated. Bottled daylight, in the form of the flashbulb, evened up photographic conditions so that documentary records could be made under all circumstances.

Today the police are among the largest users of flash. The reason lies in the fact that most accidents and crimes occur during hours when lighting conditions are poor, notably early morning, dusk, and darkness.

Police departments are, today, completely efficient. They are on their toes in matters that can aid in crime prevention or detection. They are systematic and methodical, and any innovation that can alleviate their burden, or shorten investigation time or time spent in court provides them with more time to search out and punish crime.

Their sense of composition is not the artistic one. Theirs is practical. Police pictures have to tell a story, and that is the first thing that the rookie is taught. He is taught first how to use a camera. He is provided with standard exposures which have been worked out to meet certain situations and conditions. True that he does not have time to dabble in the fine art of the camera, yet he manages to consistently bring in pictures that clearly place a crime, clues, identities, locations and possibilities. If you don't believe it, visit a few courtrooms and watch the part that police photography plays.

Lieutenant Kreml of the Evanston, Illinois, police force is an outstanding sponsor of new police methods in America. Young, alert, well-educated, his progressive attitude has affected crime prevention greatly. He was one of the first proponents of photo-documentation and has stressed the value of flash and the camera in his books and lectures. J. Edgar Hoover of the F. B. I., committed to furthering police activity and methods, was quick to accept the benefits of photography, which now plays an important part in his department. Men like Officer George T. George of the Los Angeles Police Department are to be thanked for constancy in promoting the use of the camera in police work and in developing specific methods of application. For twelve years he has been pleading the case of the camera versus crime. For eleven of those years he has been experimenting with flash photography. In the last five years he has had the pleasure of seeing his department, the Los Angeles police, climb to top-billing in departmental photography. There is no phase of photography he has not tried. He hooked up the first synchronized movie camera to a squad car to take a record of speeding cars, coupled with the rate of speed registered by the speedometer of the police car. Reporters from all over the country lauded that development on noting its efficiency.

When flash became a reliable medium, Officer George went out on calls, carrying his camera, and proved to the powers that pictures carry weight in courtrooms. Today the Los Angeles Police have fifty up-to-the-minute photographic kits travelling with squad cars all the time. Each kit contains either a Recomar 18 or a Speed Graphic complete with synchronizer and range-finder, a quantity of flash-bulbs, six cut holders, lens hood, and all other necessary accessories and materials. It is compulsory that pictures be taken of every incident that results in death or injury. Several pictures are taken of each case from varied angles to lucidly explain all circumstances. In cases of traffic accidents, tire marks and skid marks are outlined in chalk for best reproduction. More than 60% of all police pictures are taken with flash. As distortion or lack of depth of field can reverse a verdict, the intense light of flash has proven a boon as it permits wide and deep coverage. Daylight flash is rapidly gaining ground in crime photography as oftimes shadows can be illusory, or can pervert or distort an image. One specific case is best described by narration.

Early one morning a passenger alighting from the platform of a streetcar was struck by a passing automobile and was instantly killed. Passengers on the streetcar insisted that the hit-and-run vehicle had been a black panel-truck without writing or identification. A witness who had been standing on the sidewalk insisted that the truck had indeed been black, but that, contrary to the testimony of other witnesses, there had been writing on the truck in white paint. A fleeting, cursory glimpse had revealed to him the words, "Nuts to You." He was ill at ease in mentioning this phrase, aware that it sounded fantastic, and might be taken as an affront by the law. Nevertheless, further questioning revealed that he would swear to it. He admitted that the truck was in the shadow of a bridge at the time he saw it, and he might have been wrong in the wording, but this was at least a clue which the police were quick to accept. Furthermore, he stated that a plank projected diagonally from the rear of the truck. Other witnesses who had been passengers on the streetcar corroborated this last statement.

Immediately all trucks in the area were tracked down by the Los Angeles Police. A truck was found loading in the produce market that matched the description of the witnesses. Certainly enough, one side of the truck was completely black; the other side bore the facetious phrase. From the rear of the truck projected a plank. Photographs taken of the truck distinctly showing the phrase and the projecting plank were admitted as evidence. All witnesses identified the pictures and testified that the truck had been responsible for the death. The driver admitted the crime and lost his job driving a truck for a nut company whose slogan was "Nuts to You." Naturally he was convicted.

This, however, illustrates only a small part of the necessity of the camera, and particularly flash, in police photography. The Lindbergh kidnapping case was solved and closed because of photographs. Photographs of clues, the hiding place of the money, the fateful stepladder and pieces of wood that had gone into its building, of Hauptman himself compared to drawings compiled from impressions of witnesses, of fingerprints left on the window-sill as compared to those of Hauptman. Every picture that was admitted as evidence drove another wedge into alibis and pleas of not guilty, and Hauptman was convicted.

Thread from clothing, footprints in soft earth, bits of hair, or scraping from fingernails—all these are photographed to prove undeniably the guilt of criminals, and these photographs, on corroboration of witnesses, criminologists, scientists or other expert witnesses, hang many a criminal.

The closing of indecent shows has been accomplished in most cases solely through photographs of lewd and immoral acts. The strategems used to acquire the needed evidence are at times hilariously funny. Although the theatre manager is usually cagey when his show is of a sexy nature, he can sometime be taken in with a stunt that has worked so many times that it has become a standard joke among police photographers. Here is one case that actually happened in a west coast city, and which was described in newspaper accounts all over the country.

Several police photographers took a box quite near the stage at a recent show. They let word slip back to the manager, through an

"The Last Mistake" *Los Angeles Police Department*

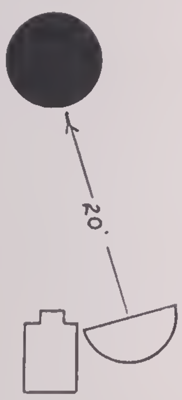


Figure 118. Data: Recomar 18 with Abbey synchronizer, 1/50 second at F:16 on Super Ortho Press. One Wabash No. 2.

usher, that they were talent scouts from the New York stage. Backstage was a beehive of activity as this information filtered through. The actors put all the "oomph" of which they were capable into their actions. The "talent scouts" took countless flash pictures of all the highly flavored episodes on the stage. Although normally there would have been objections from the management to flash photography during a performance, there was none because both cast and management were excited with the possibility of "going places."

After the show, the photographers returned to the police laboratories, made prints, and by the time the arresting officers returned with their prisoners, a complete documentary record had been made which, when presented in court brought about the conviction of principals and management of the show.

This case was easy because it had been properly planned, but often, of course, the knowledge that there are police, reformers or crusaders in the audience results in a temporary "tone-down" until they are gone. Most frequently, though, before the information has had time to filter back, several incriminating shots have already been taken. Police are now experimenting with infra-red blackout photography to facilitate this type of work.

Police photographers whose specific job it is to work with a camera all day long, are generally familiar enough with their equipment to know its operation under all circumstances. The officers in traffic squads, however, whose duties are multiple, find their job facilitated by a night exposure table which is pasted to the camera. As the officer has little time for meditation or planning on night accidents which occur on the streets, his teachings in photography lie in the fundamentals of placing the scene on the emulsion so that nothing is left to the imagination when the picture is presented as evidence or documentation. More time is spent in planning the composition of the picture than in technicalities. Thus, standard police exposures, which grant much greater latitude than is usually necessary, are compiled, applying to conditions of total darkness. Where the average photographer is told by manufacturers of flashbulbs to open his aperture two stops when shooting under conditions of great absorption, the police photographer usually shoots three or four stops better. Sometimes his negative is slightly overexposed in the foreground, but greater detail is found in the background, and errors are sometimes corrected in development. Of the many thousands of negatives examined by the writer in police files, the majority were found to be excellent in coverage for police purposes, each lucidly explaining circumstances and the story of the mishap. Those files are not available to the press, attorneys or civilians, and serve only in police work.

Note that the exposure guide illustrated here, which is a standard police guide, applies to tungsten film speed 40, shutter speed 1/50 second, synchronized. In some instances it is four or more stops wider than manufacturer's specifications, but police work has proven them practical. In their use, the officer measures the distance with a steel tape to assure perfect focus, and also because his records require exact distances.

Exposure
Super Ortho Press

Feet	F: Stop
25	4.5
22	5
20	5.6
18	6.3
16	7
14	8
12′ 8″	9
11	10
10	11
9	12.7
8	14
7	16
6′ 4″	18
5′ 7″	20
5	22
4′ 6″	25
4	29
3′ 6″	32

Above figures are obtained from calculator when set at Film Speed 40. Synchronized. Use shutter speed of 1/50 sec.

Criminals too sometimes make use of photography in their defense, sometimes resorting to darkroom-art to distort the facts. Laws have been promulgated, however, to make faking of pictures entered as evidence in court a major crime in itself. Verdicts of perjury have often been brought in to disqualify faked pictures, although in most cases honest pictures accompanied by the original negative have reversed decisions. It is unfortunate that one case where justice might have blinked her eyes, the Tom Mooney case, was not greatly affected by photographic evidence, although a picture was the principal defense. That, however, was 1916, and it was long after that that photography climbed to the prominent position it now occupies in the courtroom.

Insurance companies have staff photographers who help prove or disprove claims, and the results of their efforts are also accepted as evidence. Police departments, although sometimes urged by insurance companies to release pictures from their files, never do.

The Rogues Gallery, of course, has depended for generations on pictures for identification. Flash has made the task of the Gallery photographers easier and more certain. Often, in police line-ups, you will find flash used.

There are several burglar-alarm devices on the market which utilize flash. One of these devices, by means of an electric eye, trips the shutter of a camera, recording the image of the burglar, setting off an alarm at the same time. This is one specific case where pictures do not lie.

In every "who-done-it" movie you see, the coroner enters the scene accompanied by a photographer, who takes pictures of the spot marked "X." The coroner's photographer has a technique that differs again from customary photography. His picture must reveal every tell-tale clue, while at the same time explaining the scene. His job is gruesome, but it does not affect his appetite because when viewed objectively, his subject is little different from other still life, except that it offers more complications.

One unpleasant phase of police photography is explained lucidly in the general use of ortho film instead of pan. Ortho film will register all blemishes, marks, and bloodstains. Now that a new ortho film with a faster rating has made its appearance, police photography should show even greater improvement than it has in the last few years.

The police photographer does not depict glamour. His pictures never receive the limelight that is bestowed upon commercial men and advanced amateurs. He is prohibited by law from hanging his work in salons or from selling or displaying or permitting his pictures to be sold or displayed. His daily work goes into a secret file, and his pictures are seen only by his superiors in his department and principals in criminal cases. His only photographic gratification lies in the successful closing of a case.

The Movie Still Photographer

There are only 104 movie still men registered in Hollywood. Only those 104 can work in the studios. Most of them are on regular payroll or contract. These men take an almost unbelievable number of pictures each week. One major studio alone records a weekly average of approximately ten thousand stills. Possibly you are thinking—"What has this to do with flash?" Flash photography is new. It is daily becoming more nearly indispensable to the selling of movies. Publicity stills are usually taken with flash. New methods of application and usage are constantly being sought. As an example, the manufacturers of flashbulbs have stationed technical men in Hollywood to assist still men in developing new techniques, and in mastering old ones. Many new techniques do emanate from Hollywood.

It is rapidly being found that heavy spots and floods in the portrait studio can be advantageously replaced with flash. The same techniques of key and filler as well as backlight can be applied, with greater convenience and ease to the subject. Today photographers are succeeding in applying the light of flashbulbs to every circumstance of good portraiture that formerly required other means of lighting. Flash is easier on the subject. It permits natural expressions. It saves the bother of renewing melting make-up. Most important, it is portable and can be applied to circumstances where other light is not flexible or attainable.

Movie still photography is in a class all its own. A good still picture used in movie publicity must contain action, appeal and spontaneity. It must encompass new gags, new camera angles, new

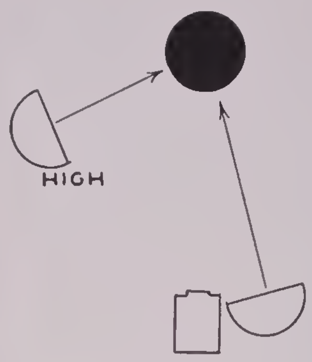


Figure 119.

Anne Miller—Columbia Pictures Photo by Whitey Schafer.

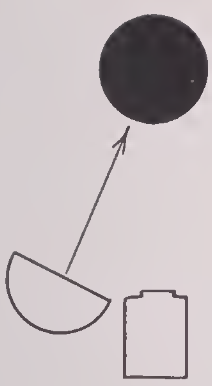
Two medium flashbulbs, one at right, aimed at background and subject, one very high at left.

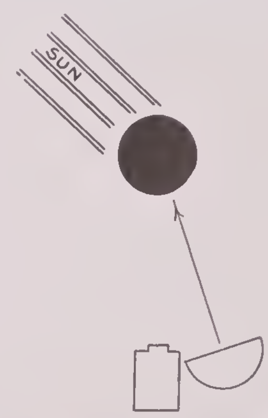
expressions, and must tell a story. It must strike the fancy of the newspaper and magazine reader, and must invite them to their theatres.

It is understandable that pictures with all these features must be tracked down at their source rather than set up in the studio. Having variable light conditions to contend with portable light must be carried.

There are three phases of still photography on the movie lot. The first is studio portraiture. This is strictly glamour stuff which is carefully planned and which is done by appointment. (Figure 119.) The second is assignment to production. Certain men work on the movie stage reporting with the actors, cinematographers, and directors and carefully watching for picture possibilities; movie camera reloads and technical delays afford the still photographer his only opportunities to take representative pictures for publicity. (Figure 120.) The third is straight publicity. In this last phase the still man must constantly think of new ideas, must take pictures around the lot whenever circumstances permit, must go to previews and parties,

Marlene Dietrich—Warner Brothers *Photo by Mack Elliott*
Figure 120. One small bulb on camera.





Anne Gwynne—Universal Pictures *Photo by Roman Freulich*
Figure 121. Synchro-sunlight, one flashbulb at camera.

must photograph actors and actresses in their homes (Figure 121), and must get "gag" pictures which create extra reasons for publication in the press.

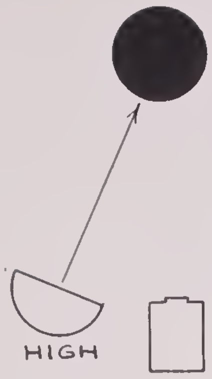
In some cases the department head shuffles assignments, alternating his staff on various jobs. On some, priority, ability, or reputation, determines the assignment and it remains permanent.

Recently A. L. (Whitey) Schafer, head of the Columbia Pictures staff, set up multiple flash units in his portrait studio to supplement other lighting, and is now doing a great deal of portraiture with flash. Before adopting the camera, Whitey was a commercial artist and his modus operandi is affected by his previous training. He figures out his picture diagrammatically on a sketch pad before photographing it, calculating his lighting angles, exposures, poses, and props at the same time. When a star appears for a series of pictures, Whitey's assistants place the flash extensions according to plan, and without delay or hardship to the subject the work is completed.

Among the tips passed on by several important photographers are these: for the sake of modelling, use two bulbs. If only one bulb must be used have a long cord put on your gun. Mount your camera on a tripod, carry your gun to one side or another of the camera, so that your light will come from the side, and not from the front. If it is possible to use two or more bulbs, glamour effects can be had that are flattering. One bulb should be a main light and should be placed about four feet higher than the level of the lens. The second bulb should be used to balance the lighting as a fill-in. An additional bulb as a back light adds distinction, high-lighting the hair and costume, and bringing out a critical outline, as well as softening shadows. If, in glamour-flash, soft tones are desired, several means can be used to diffuse the light. One is the use of white silk, or thin white tissue paper snapped taut in hoops and placed over the reflectors.

Ray Jones, who heads the Universal Pictures still department, has this suggestion on flash in child portraiture: "Baby Sandy, one of Universal's prize subjects, is always photographed with flash as it is the only logical light-source for baby photography. It works no hardship on children, lends itself to varying facial expressions, and is so informal that it does not put children on edge."

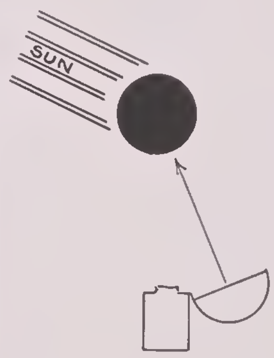
Jones recommends the careful study of movie stills by those who



Jane Frazee—Universal Pictures

Photo by Ed Estabrook

Figure 122. One small bulb to left and higher than camera.



Baby Sandy—Universal Pictures

Photo by Ed Estabrook

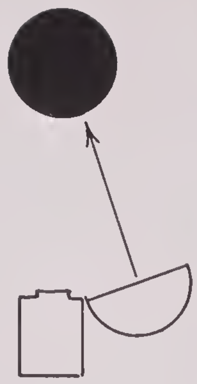
Figure 123. Synchro-sunlight, one small bulb at camera for fill-in.

would like to do comparable work. Jones heads a staff of forty-four men, is the guiding genius at Universal, has been a still photographer for almost twenty years, and, like Rembrandt and Leonardo DaVinci, received his original experience in photographing skin quality by using cadavers as his subjects. Jones became a photographer at the age of 14, taking pictures of corpses in caskets. It taught him a good deal and started him on a prominent photographic career.

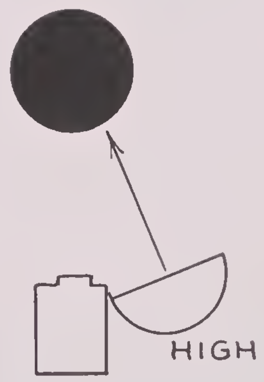
Ed Estabrook's picture of Jane Frazee, Universal star, is an excellent example of single flash, and is a good "gag" shot. Ed, asked to get a picture with an Easter motif for the press (Figure 122), arranged very simple props that set the subject off to advantage. The bunny carried out the Easter theme and the picture is a good example of leg-art. Interest in Miss Frazee's new motion picture was created by this still and most newspapers and magazines were glad to feature it, as it fits nicely into the "Diversion" class. Photographically it is well planned, and though only one light source is used, skin tones and highlights are nicely shown. By moving the subject about six feet from the wall, the shadow could have been eliminated. By using a backlight, the wall could have been lightened. The flashbulb was held high and to the left side of the camera, giving the picture the modelled effect.

Estabrook's pictures of Baby Sandy are excellent examples of the one flashbulb method. (Figures 123-125.) In each of these pictures the light was held high and to the left.

Emmett Schoenbaum's picture of Alice Faye (Figure 126) points out the benefit of two bulbs. Had only one bulb been used at the camera, the shadow of the flowers would have kicked back at the subject, or else placement of the bulb at the left would have shadowed the right side of Miss Faye's face. With one small bulb at the left, and a large bulb at the right of the camera, perfect modelling resulted, with highlights on the hair. A third bulb as a back light would have improved the picture, but time was limited and quarters were cramped. A similar effect was had in Whitey Schafer's action picture of Ann Miller (Figure 119), in which diffused bulbs of equal intensity were used, one high to the left, and one at the right of the camera aimed at the background, with part of the light striking the



Baby Sandy—Universal Pictures
Photo by Ed Estabrook
Figure 124. One small bulb.



Baby Sandy—Universal Pictures
Photo by Ed Estabrook
Figure 125. One small bulb, high.

"Alice Faye—20th Century-Fox
Photo by Emmett Schoenbaum
Figure 126. One large bulb, one small, as indicated.

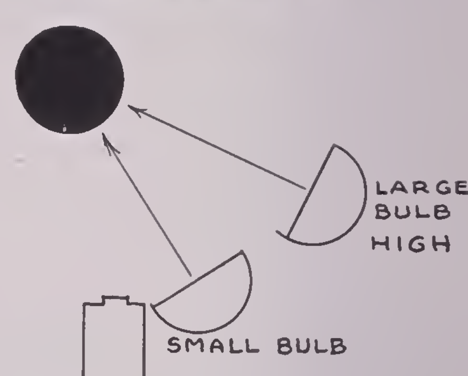


Figure 127. Mike McGreal and Bill Ohrm of Warner Brothers discuss Scotty Welbourne's prize winning color shot.
Photo by Marty Crail.
Two flash bulbs as indicated.

subject. The bulb on the left was placed about four feet higher than and almost directly above Miss Miller.

When taking pictures of this nature, several thoughts should be kept in mind. First, think before taking a picture. If possible, plan it and follow your plan instead of just snapshooting. Try to visualize the finished result when placing your lights. Acquaint yourself with your equipment. Learn diplomacy in dealing with people. Try to learn from the methods used by successful photographers and until you have found yourself, experiment with various methods, keeping a record of your experiments so that you can refer back and benefit by your trials.

At Warner Brothers, E. B. (Mike) McGreal (Figure 127), who heads a large staff of top men, among them Elmer Fryer, Scotty Welbourne, Muky Munkacsi and many others, was one of the first men to experiment with flash, and later, the first to use flash for all color photography. For the past two years the Warner Brothers laboratories, the largest in the world, have sent out a constant stream of color prints to the press for use in roto sections. Mike McGreal suggests that the photographer who wants to go places should experiment with various phases of photography until he knows what he likes best and excels in, then specialize in one phase. Specialization, says McGreal, brings success closer.

Charles Goldie, head of the Twentieth Century Fox photographic department recommends that the amateur take advantage of public schools that feature photo courses in which several men at Fox got their fundamental training.

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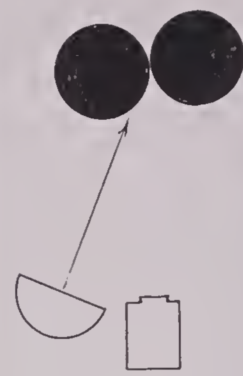
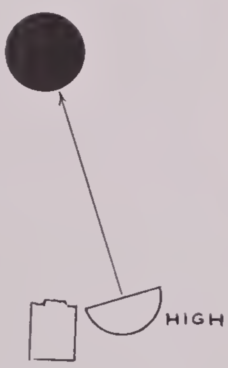
It will be noted that the technical data is much less specific in this chapter. The studios, for reasons that may be appreciated, refuse to release any information that might be construed as a "plug" for any specific commercial product.



Bob Hope and Paulette Goddard
—Paramount Pictures

Photo by Malcolm Bullock
Figure 128. One flash bulb.



Ann Sheridan—Warner Bros.

Photo by Elmer Fryer

Figure 129. Synchro-sunlight, one bulb at camera.

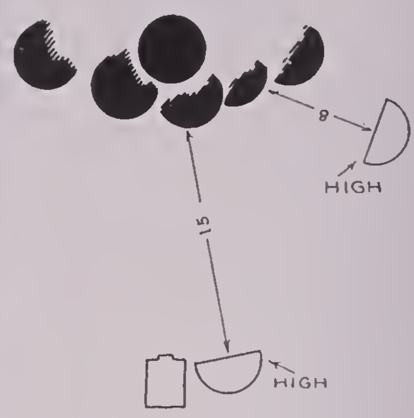
Radio Publicity Photography

Ted Allan, photographer for the Hollywood studios of the Columbia Broadcasting System, takes pictures of all the prominent radio stars. His pictures are released to radio magazines and newspapers, and are constantly in the public eye.

There is little fundamental difference in the nature of his job and that of a movie still man. Allan's work differs only in that he invites the listener to tune in certain programs on his radio, instead of inviting them to a theatre seat. In that endeavor the theme must always stress the radio broadcasts, or certain characters portrayed on the air.

In all pictures taken at the microphone, flash is the only permissible light medium. Some years ago, a visitor from the press, in trying to use floods, plugged them into the power line and blew a main fuse, thus throwing the radio system off the air for ten minutes. That incident resulted in a ruling that permitted only flash to be used in the studios.

Ted Allan uses at least two flashbulbs, one on an extension for a high back-light, giving a third dimensional effect. In radio, unlike movies, the reader likes to see groups of characters instead of one main subject, and this necessitates the use of as many as three or four bulbs on group shots. Even in the case of individuals photographed, two bulbs are used if possible.



"Senator Fishface's Platform"
Ted Allan

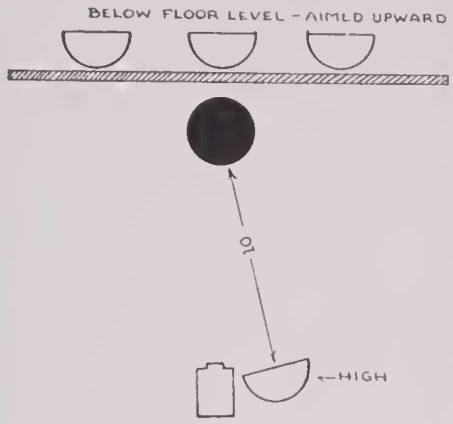
Figure 130. Data: 4x5 Speed Graphic with Jacobson synchronizer, 1/200 second at F:16 on Tri X Pan. Two Wabash No. 2.

Senator Fishface runs for election on a platform that would place an Earl Carroll girl as a hostess in every streetcar.

Imagination is vital in radio publicity to arouse interest. As a result, every picture of a comedian must of necessity be a "gag" shot, and new gags must constantly be thought up. The reader wants to see Gracie Allen or Eddie Cantor performing some act, rather than looking glamorous. Senator Fishface is a problem for Allan because his campaigns are legion. In the illustration of the Senator's platform (Figure 130), Allan expressed an idea that drew thousands of new listeners to their radios.

The first print Allan ever made was 8 feet by 10 feet. He bluffed his way into a photographic agency that made master murals, and succeeded in his bluff. Later he opened a photographic concession in a department store and continually lost money by giving the public costly pictures for practically nothing. Then a major movie studio asked him to join their ranks and he graduated from the movies to radio, and at the age of 31, is tops in the radio field.

Secret of his success in radio photography: try to get a candid effect, even if the picture is posed. Flash is essential to this effect.

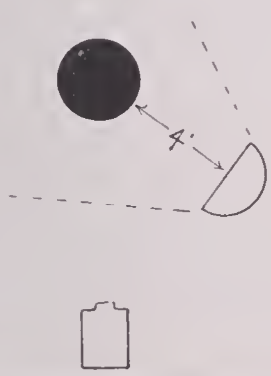


"Ona Munson"

Ted Allan

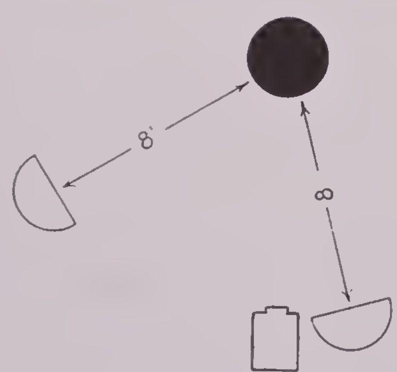
Figure 131. Data: 8x10 Eastman View with Jacobson synchronizer, open-and-shut at F:32 on Tri X Pan.

Three Wabash No. 0, One Wabash No. 2.



"Charles Correll" (Andy of Amos and Andy) *Ted Allan*

Figure 133. Data: 4x5 Speed Graphic with Jacobson synchronizer, 1/200 second at F:32 on Tri X Pan. One Wabash Press-40 diffused with handkerchief and placed under dashboard of plane. (Picture would be improved by another bulb placed at camera.)



"Jean Hersholt" *Ted Allan*

Figure 132. 4x5 Speed Graphic with Jacobson synchronizer, 1/200 second at F:16 on Tri X Pan. One large bulb outside window, one medium bulb on camera.

Aviation Flash Photography

Larry Kronquist of Douglas Aircraft, whose excellent illustrations are accompanied by his own explanation of each picture, has developed a "shadow eye" to determine what stop to use. If he is underneath the plane, and little daylight passes the heavy structure, he works practically under night conditions, depending upon the flash as the principal light source. If, however, sunlight is the principal source, and flash is used to brighten shadows, exposure is generally made for sunlight, with the light from the bulbs taking care of the shadows.

Kronquist takes color pictures and black-and-whites of every assignment. Although defense at present takes almost all Douglas production, publicity is continued for times of peace, and the expected increase in civilian aviation. At the same time, with military production, as in the case of the world's largest plane, the B-19, publicity is continued to keep the public informed, and to help morale. These pictures are taken under a handicap as certain parts of the cockpit and structural design cannot be shown for military reasons. Pictures cannot be taken of control panels, although they are sometimes very colorful.

A synchronized view camera and a 4x5 Speed Graphic with Abbey synchronizer are used, and several flashbulbs are used on almost all pictures. In the picture showing mass production inside the plant, a series of bulbs were placed in strategic spots behind pillars all along the line to light the entire assembly. Exposure was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figured for the front bulb at the camera, and as other bulbs were placed to cover individual areas beyond the range of the first bulb, the picture was well balanced.

Kronquist has an eye for composition that was developed through the study of art. He has been a photographer for only two years, and has gained fame and fortune at such a rapid rate that he is still startled by it. He studies photographic trends avoraciously, and plans his pictures as he would plan paintings.

For all of his color work he uses daylight film and daylight blue bulbs. Often, to liven skin tones, he breaks precedent with daylight color film by using blue bulbs to bring out the coldness of the metal, but the lower color-temperature standard flashbulbs to liven the face of a human subject. Thus the metal looks cold and blue, and the face has natural skin tones.

On one assignment he tried to photograph camouflaged airplanes from the sky, but found that they blended too well with the earth to be seen. All that was visible to the eye was the shadow on the ground. Color pictures of those camouflaged planes, with flash, made them visible, but the transparencies were destroyed later as being strategically too informative.

As an avocation, after taking industrial aviation pictures that appear in print all over the world, Larry Kronquist photographs his little daughter, always using flash on his pictures. He refuses to use any other light source, and proves their worth by the quality of pictures he makes.

"Biggest Tail in the World"—4x5 Speed Graphic—special ground tripod, Schneider wide angle lens—light yellow filter—one #21 bulb was used to give more detail under tail surfaces. A nicely composed shot—being reproduced in color and black and white in numerous magazines and newspapers. The shot was made at 1/25 second—stop ?—

Figure 134. Photo by Lawrence Kronquist, Special Photographer for Douglas Aircraft Co.

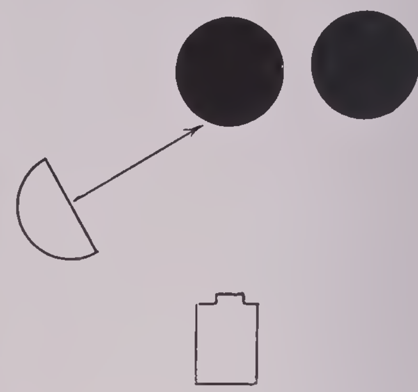


Figure 135. Working on the nose of a Douglas "Havoc" night fighter (for Britain). Only one 40,000 flash bulb in an extension, no fill-in light, so as to cut down distracting elements — very careful as to the placing of the reflector so shadows of the nose frame work would not spoil the picture. Abbey flashgun—4x5 Speed Graphic —5¼ lens—Agfa Triple S film— 1/100 second—Tripod used.

Photo by Lawrence Kronquist, Special photographer for Douglas Aircraft Co.

Figure 136.

Synchro-Sunlight flash shot, or rather a slow shot, 1/25 second with flash bulbs to bring out the mass production line. A press 25 bulb used on the camera—one large reflector with a 40,000 bulb about 12 feet to the left of the camera and a string of bulbs (some #21's) placed along the right hand side, all out of sight except the edge of first reflector. All bulbs were connected to an Abbey flash outfit using dry cell batteries and a transformer to cut the juice down for the tripper.

Figure 137.

Synchro-sunlight flash shot of the nose of the 82 ton Douglas B-19 Bomber. 1/100 second—light yellow filter—stop ?—3½" wide angle lens —40,000 press bulb for fill-in—4x5 Speed Graphic—Abbey Super Press Flashgun. Camera on special 8-inch tripod. Agfa Triple S film.

Photo by Lawrence Kronquist, Special photographer for Douglas Aircraft Co.

Figure 138.

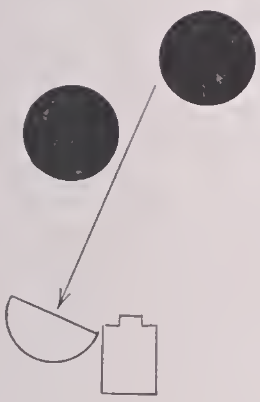
"Gargantua," a spectacular synchro-sunlight flash shot of one of the four 2,000 H.P. engines on the giant Douglas B-19 Bomber. 4x5 Speed Graphic, 3½" wide angle lens, camera on special 8 inch tripod so as to get the low angle so necessary to show the power and vastness of the world's largest plane. Abbey flashgun, spot reflector on camera, one 40,000 press bulb used as a fill-in light and to show more detail under the wing. 1/200 second — Agfa Triple S film—stop ?—light yellow filter.

Photo by Lawrence Kronquist, Special photographer for Douglas Aircraft Co.

Clinical Flash Photography

The medical profession depends on flash photography to document ailments, to illustrate conditions to patients, to help in diagnosis, to explain circumstances to students, and to record treatment before and after surgery. Flash is the fundamental light for clinical photography because it permits small apertures and critical definition of tissue.

The Leica and Contax have long been used for color and black-and-white medical recording, but the development of several specially designed cameras has widened the scope of clinical photography. One, the Cameron Color Flash Clinical Camera (Figure 139), has allied flash photography with medicine on a scale never before attained. This camera houses a flashbulb, which shoots a defined beam of light at the subject. It is a streamlined portable camera equipped with a conical adaptor for special use, and three standard dry cells are positioned inside the housing for lighting a focussing lamp within the camera, and also to fire the flashbulb. A sigmoidoscopic tube can be attached to the lens for insertion into an incision or almost any part of the anatomy. With its sharp flash definition, it permits endoscopic, orificial, superficial, portrait or general scientific pictures that render, in either black-and-white or color, clear and specific documentation of causes, conditions and procedures.



"Dental Photography" *Hugh F. Smith*

Courtesy Cameron Surgical Specialty Co.

Figure 139. This camera is designed for medical or dental use. A flashbulb is housed inside the camera and is synchronized with the shutter. When the shutter is tripped, the bulb fires, shooting a concentrated beam of light into the mouth of the patient, permitting a stopped down, critical record. For medical use, a tube, attached to the lens, permits injection into incisions or parts of the human system.

In use with the sigmoidoscopic tube, the flashbulb is fired, and a series of mirrors and prisms direct the light into the sigmoidoscope, at the same time tripping the shutter, and carrying the light through the tube which in turn relays the image back to the film. If the picture is taken in color, the transparency can later be projected on a screen, and examination of tissue discoloration indicates whether operation or further treatment is required. The flashbulb used is the small #0 size, and exposures for this particular equipment have been determined by the manufacturers on the basis of experiments.

And in Conclusion—

We have tried, in this book on Flash Photography, to lay a groundwork for the amateur, a design for improvement for the advanced photographer, and a clearing house of ideas for the expert. In that endeavor we hope that we have been successful.

We make one parting suggestion, and that is that you refer to these pages often. Occasional reference to diagrammatic material will assist you in planning your effects. Comparison with the work of established experts will suggest improvements. It is not the equipment that determines the picture so much as the diligence and intelligence of the photographer.

The future undoubtedly will bring forth many radical improvements in flash equipment, but the procedures outlined in this book are basic and fundamental, and with them you can make pictures that you will be proud to acknowledge in years to come.

William Mortensen
Don M. Paul

Appendix

Appendix A

Method of Determining Pilot Numbers

In the chapter on portraiture we give a list of "pilot exposures" based on the use of T-20 500 watt lamps in Solite reflectors. These units were chosen as being readily available standard equipment. For those who wish to calculate pilot numbers for their own type of equipment, or to verify the list given in Table XIV, we herewith outline the method followed in determining these "pilot exposures."

Practically any type of lighting units will serve for this purpose. However, all units used together must be identical.

Let us say that you want to determine the pilot exposure number for Wabash Press-25 at 1/200 second. From Table IX take the "flash number" for Wabash Press-25 in regular reflector with A film. This is found to be 100. From the flash number, determine the proper F: setting for a lamp distance of 10 feet. The proper setting is obviously F:10.

Now place your T-20 500 watt unit (or whatever other standard you may select) exactly 10 feet from a subject of medium complexion. Turn on the light and, with your Weston meter set for a film speed of 64, take a reading of the light area of the subject's face. Turn the arrow on your calculator dial to this number. Opposite F:10 (which we have already determined as the correct setting for a Press-25 at 10 feet) you will find the *pilot exposure number*. For example, a T-20 500 watt lamp in a Solite reflector (the unit I have taken as a standard for Table XIV) at 10 feet will give a reading of 2.5. Setting this up on the calculator dial, already set for a film speed of 64, we find ½ second opposite F:10. Therefore, ½ second is (in terms of the chosen standard) the pilot exposure number for the Press-25 in a regular reflector at 1/200 second.

This pilot exposure number holds true for any combination or grouping of identical units.