These two No. 5 capless flashbulbs, though similar in light output, in price, and in quality, are made by G.E.C. and Philips respectively. Different in shape but equally reliable they are the more powerful brothers of the No. 1 flashbulbs.

**How it all started**

The small sleek flashbulb you purchase for 8d. does not seem to have much connection with the 1850s, though that in fact is when it really started, when in 1851 Fox Talbot, sometimes known as the father of photography, first photographed a moving object by using an electric spark.

His method was more of academic interest than practical use, but it was the true beginning of flash photography. Unfortunately, his interest lapsed, and no more was thought of artificial light photography until 1859 when R. Bunsen discovered that magnesium wire, and later magnesium ribbon; burned with an intense white light and reduced the lengthy exposures to a reasonable amount for indoor work.

In 1865 Traill Taylor first used magnesium flash powder to obtain instantaneous exposures without any other light source.

**The first bulb**

Development was slow after this, and it was not until 1898 and 1899 when Kiesling, a German, and Smith, an Englishman, discovered the possibilities of burning a mixture of magnesium and aluminium in a glass bulb.

A further development of this, and the immediate forefather of today's bulbs, was made by J. Ostermeier in 1929 who coiled up aluminium wire, then aluminium foil in an oxygen-filled bulb. Immediately after this, in 1930 Philips produced their first flashbulb, which used a magnesium and aluminium mixture in a gas-filled bulb, using carbon disulphide and nitrogen monoxide as the gas.

Directly descended from this was the original Photoflux bulb first produced in 1934. There have been no major changes in bulb design up to the present date, with the exception that the flash medium is now being changed to zirconium foil, which gives far more power for the same size bulb, or as much power from a much smaller bulb. The most generally available types of flashbulbs in this country are the Mazda series, the Osram series, and the Philips series.

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Although there are slight differences in manufacture, whichever of these flashbulbs you use will be sure of absolute satisfaction. Years of research have perfected them, old stories of exploding flashbulbs no longer exist because flashbulbs no longer explode, and the light output is absolutely constant and predictable.

**How they work**

The glass bulb is secured by a cement mixture to a metal cap, with two wires passing through the cap into the bulb joined together in the centre of the bulb by a thin igniter filament. With capless bulbs, the two wires are simply bent up opposite sides of the bottom of the bulb and held in place by a washer. Inside the bulb on the ends of the wires are blobs of priming paste and the bulb envelope itself is filled with a predetermined quantity of combustible wire or foil. The trend today is to use zirconium foil. The bulb is first exhausted of air, then refilled with pure oxygen at something less than normal atmospheric pressure. When an electric current is passed through the wires, it first fires the igniter filament, this in turn ignites the priming paste, and the priming paste ignites the foil. The whole sequence takes place in a tiny fraction of time, and the brilliant flash you see is actually very rapid burning of the bulb's foil filling.

**The safety factor**

When the bulb is fired, considerable pressure is caused inside the bulb, which rises to about four times atmospheric pressure. To allow for this, to prevent the bulb exploding, and to provide a very considerable safety factor all glass envelopes are tested to withstand an internal pressure of approximately 15 times atmospheric pressure, and even further, are coated with varnish which itself is capable of withstanding up to three or four times atmospheric pressure.

Thanks to these precautions, an exploding flashbulb is unknown in modern flash photography. If however the glass bulb is cracked, thus producing among other things a weakness in the bulb there is just a possibility that it could explode. To guard against this possibility, some flashbulbs contain
Modern single lens reflex cameras have two distinct 3-mm coaxial plug sockets, one for X synchronisation, used for electronic flash, and one for M synchronisation for use with expendable bulbs.

Cameras with between-lens shutters have a common 3-mm coaxial socket for both X and M synchronisation. The transfer from one type to the other is accomplished by a small lever as shown above.

Two inexpensive flashguns with non-folding reflectors, but with the bulb in a different position relative to the reflector. Although one has a polished reflector and the other a stippled reflector, performance is similar due to other changes in design such as reflector curve and bulb position.

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a blue safety spot inside them. It is composed of a cobalt salt which reacts to moisture and will turn pink if the bulb is not absolutely perfect.

Types of flashbulbs

When a flashbulb is fired, it does not reach its maximum brightness immediately: It starts to burn, reaches its full intensity, then starts to die away. The time from the beginning of the burning to peak illumination is the basis of classification for flashbulbs. They are all classified in relation to their time to reach peak output.

There are three types, type M, which takes between 18 and 20 milliseconds to reach peak; type S, which takes as much as 30 milliseconds to reach peak, and type FP for use with focal plane shutters having a very long flash peak reached after about 16 to 18 milliseconds and lasting for something over 20 milliseconds.

A No. 1 and No. 5 flashbulb are both class M bulbs, and are manufactured by Mazda, Osram, and Philips, a No. 1 costing approximately 8d. and a No. 5 a more powerful bulb, approximately 1/-.

The class S bulb reaching peak output 30 milliseconds after contact is only used when maximum lighting is required, and is only available through Philips, classified as the PF 100. Class FP bulbs used for focal plane shutters are classified as PF 24 or PF 45 the latter having a greater light output and again are manufactured by Philips.

Synchronisation

Modern shutters have two types of synchronisation, controlled by a small lever on the shutter and marked X and M. Older cameras with focal plane shutters had F type synchronisation, but these are virtually obsolete now and all modern focal plane miniatures have X M synchronisation.

Flash contacts inside the shutter close when the shutter is operated. These flash contacts connect with an external plug on the camera or on the shutter, and act as the switch in the flash circuit. Although there are various types of flashplugs, the standard form is the three millimetre coaxial compur plug, except on some box-type cameras which have variations of a two-plug fitting to fit a flashgun specifically designed for that camera.
**X-type synchronisation**

With this, there is no delay between the shutter opening and contact being made. Contact is made directly the shutter is fully open. With this type of synchronisation, class M flashbulbs can be used at shutter speeds up to 1/30 sec. or electronic flash at any speed. With shorter shutter speeds, the shutter would be open and closed before the flashbulb had time to reach its peak, and gross under-exposure due to incorrect synchronisation would be the result. With electronic flash, however, there is no delay from time of firing to peak, and as the flash duration is so short, being about 1/500 sec. or less, shutter speeds are immaterial.

**M-type synchronisation**

With this type of synchronisation, a delay mechanism is incorporated in the shutter so that although contact is made when the shutter is operated it does not open until 16 to 18 milliseconds after this period. This allows the flashbulb to build up to peak before the shutter opens. Because of this delay, electronic flash cannot be used with M synchronisation. Class M bulbs, however, can be used at any shutter speed with some modification to the flash factor at shutter speeds over 1/100 sec.

**Use this table**

With X synchronisation:

Electronic flash can be used at all speeds.
Class M flashbulbs can be used up to speeds of 1/30 sec.

With M synchronisation:

Do not use electronic flash
Class M flashbulbs can be used at all speeds.

**Flashguns**

Basically, a flashgun consists of a body, usually made of plastic, which houses the power source, (which in the majority of flashguns is a standard 22½ volt deaflaid battery), a flashbulb holder, and a reflector to direct the light. The foot of the body always has a shoe of some description by which it can be attached to the camera or to a camera bar, and a thin piece of plastic

These two flashguns both have folding reflectors which collapse, fan-like for easy storage and carrying, both have embossed surfaces, one being small hammer-punch finish, and the other a stipple finished, the bowl of one being extremely shallow and of the other, a far deeper curve. Each will have different characteristics, and will correspondingly affect the guide number of the bulb in use. One or two simple experiments will soon enable you to find out the precise flash factor for any particular bulb and your own flashgun.

**PROFESSIONAL**

This is a slave unit, which can be used up to 40 ft. from the master flash on your camera, and is fired by a photo-electric cell built into the slave unit. The one great advantage of this type of extension flash is that it completely eliminates trailing wires.

Typical of the more expensive professional-type guns, this one accepts the large flashbulbs with E.S. fitting base, and is powered by several U2 torch batteries. It has provision for extension and open flash.
ALL ABOUT FLASH

Some cameras have flashguns specially designed for them. The picture above is of the Rolleiflash, and Rolleiflash extension unit, designed for use with Rollei cameras.

ELECTRONIC FLASH

Electronic flashguns do not use expendable bulbs, but a gas-filled tube as shown above. When a high-voltage current is passed through this gas, an extremely fast, high-intensity flash is the result. Most flashtubes will give approximately 20,000 flashes before their useful life is finished. Photograph by courtesy of E.M.I. Electronics Ltd.

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covered flex which connects the electrical circuit of the gun to the camera’s synchronising plug.

All modern flashguns accept the capless type of bulb, but a few of the older models are still equipped to take the capped type of bulb and need an adaptor to convert them for capless bulbs.

Constant power

In very early flashguns, the current from the battery was fed direct to the flashbulb, but for some years now all flashguns have incorporated a capacitor in the circuit. This ensures that even though the battery may be a little flat the current reaching the bulb is always constant, because the capacitor stores up the current from the battery until it reaches the correct amount to fire the bulb.

The more you pay for your flashgun the more refinements you can expect. Some have a small test lamp built into the circuit, operated by pressing a built-in button, showing that the circuit is in good order before firing the bulb. Some guns have additional outlet sockets built into the side or back, accepting extension flash units which are needed if you want to use flash, but need more than one light source.

Reflectors vary tremendously, from shallow bowls of polished aluminium to ridged surfaces, and hammered surfaces, and to multi-leaved reflector bowls which fold up fan-like for easy storage.

Big brother

The most expensive flashguns of all which use expendable bulbs are the professional type powered by two or three U2 batteries, and accepting the large type of professional flashbulbs such as the PF 60 which is fitted with an Edison screw thread. These are rarely needed for amateur photography, but it is nice to know they are available if you want something which will give you the maximum possible light output from a bulb.

Although we said earlier that all expendable bulb guns are powered by an electric battery, there is, as always, an exception. One gun on the market is powered by the very latest type of nickel cadmium accumulator, thus needing no battery, and the accumulator can be charged from the mains.
The reflector is perhaps the most important part of a flashgun, varying tremendously in efficiency. The output from any given type of flashbulb is always constant, but the amount of light which can be utilised varies, because the more simple types of reflector only reflect perhaps 20-30 per cent of the available light, whereas the more efficient types may utilise as much as 60-70 per cent. The factors controlling the efficiency of the reflector are its size in comparison to the flashbulb being used, its shape, and its surface. Generally speaking, the larger the reflector the more light it will collect and reflect, and again speaking generally, the most efficient shape is the true parabola which reflects light in a beam. The position of the bulb in relation to the reflector decides whether or not this beam converges, diverges or is parallel. In most guns the bulb position is so placed that the divergent beam is of approximately the same angle as that covered by a standard focal length camera lens. The smooth polished type of reflector is perhaps most efficient in terms of light out-put, but can give rise to areas of uneven illumination. Reflector surfaces which are stippled, or hammer finished, and those which are satin finished, diffuse the light rather more but are still extremely efficient.

Electronic Flash

The major difference between expendable bulbs and electronic flash, is that whereas a bulb may only be used once, in the electronic variety it can be used for many thousands of flashes. It is a sobering thought that although an electronic flashgun may cost you from £15 to £50, the bulb itself being a very expensive item indeed, its life is no more than about 20 secs. This may not sound much, but when you reflect that each flash occupies only 1/1000 sec., it becomes obvious that a flash tube will give approximately 20,000 flashes before it is finished. As somebody once said “this is a heck of a lot of flashes”.

Another important difference is the duration of the flash. With bulbs the effective flash speed is about 1/30 sec., whereas with electronic varieties, the speed varies from a minimum of 1/500 sec. to a maximum of perhaps 1/2000 sec. In the early days, all electronic flash had a duration of at least 1/1000 sec., and it was a popular pastime to see what action they could

An extremely useful type of electronic flashgun needing no separate power pack, but with the batteries stored in the handle, a neon indicator is fitted on the top casing to show when the gun is ready to fire.

This type of electronic flashgun is powered by nickle cadmium accumulators that need no attention throughout their long life. It can be operated either directly from the mains, or from the accumulators which can be re-charged via the mains.

Practical Photography,
Typical of the inexpensive high-quality flashguns powered by four U2 batteries which will give up to about 400-500 flashes per set.

This is the heavy duty professional type electronic flashgun equally suitable for use by keen amateurs who do a fair amount of flash work. Embodying the very latest type of fully automatic transistor controlled system it can be operated at full power or half power from the mains or from an accumulator.

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stop. There were innumerable pictures of dripping taps, with a water droplet frozen in mid air between the end of the tap and the sink, bursting milk bottles, and leaping ballet dancers. Today however, although the novelty has worn off, it is still a very useful aspect of electronic photography.

**How they work**

Usually powered by an accumulator, a nickel cadmium cell, or a series of high tension batteries, the electrical energy from these is passed between two electrodes in a gas-filled glass bulb via a capacitor, thus producing a short duration high intensity flash. With the exception of electronic flashguns powered entirely by high tension batteries all can be re-charged from the mains, and in many cases can be operated directly from the mains.

**Do you need electronic or bulb?**

If you only use or intend to use flash occasionally, then your needs will be well met by the expendable bulb type of flashgun, when your flash-pictures will cost you approximately 8d. per shot. If however, you are going to use flash a lot, using it not only as the main lighting source, but as fill-in on many occasions, then you would do well to invest in an electronic unit which though it may cost you around £15 will save you money in the long run.

**Slave units**

A slave unit is essentially a flashgun with its own power supply, its own bulb, and its own reflector, but fired not by depressing the camera release, but by the light emitted from the master flashgun, in other words the flashgun on your camera. Your original flash actuates a photoelectric cell set into the slave unit, which fires the slave-unit bulb. The advantage of these units is that you can place your second flash in any desired position to act as fill in, modelling light, background light, or in fact, any position where you would normally place the second light; yet there are no trailing connecting wires. Although relatively expensive, these slave-flash units are a very useful part of your flash armoury.
Calculating your exposures

With the absolute minimum of knowledge you can get perfectly exposed flash-pictures every time. You need to know three things:—
The speed of the film you are using.
The guide number of the bulb you are using.
The distance between your flashgun and your subject.

The guide number

Every manufacturer works out a guide number or flash factor to be used when his bulb is used in conjunction with any given film. As an example, a PF 1 flash bulb when used with a film rated between 12 and 20 ASA has a guide number of approximately 50. If however the same bulb were used with a film rated between 100 and 160 ASA the guide number would be increased correspondingly to 140.

Having established the guide number appropriate to your bulb and film, all you have to do is measure the distance between your flashgun and your subject and divide this into the guide number. The answer will be the f number to which you should set your lens aperture. If your guide number is 100 and the distance between your flashgun and subject is 10ft. then 100÷10 is 10 consequently you set f/10, or in point of fact the nearest appropriate setting, f/11, on your lens. The manufacturer works out these guide numbers under certain conditions, which assume that you will be using a well designed reflector of four or five inches diameter, that your exposures will be made under frontal lighting condition, that you will be photographing subjects of medium tone, and that the photographs will be taken in a fairly large room with medium coloured walls and ceiling.

Make allowances

Obviously, all these conditions will not apply and you must make due allowance. If for instance, your pictures are being taken in a very small room with white walls and ceilings you would work out the necessary aperture then reduce it by one full stop. If on the other hand you were shooting out of doors on a dark night, where there were no reflecting surfaces you would work out the required aperture then open up your lens by 1 to 1½ stops.

WHAT TYPE? WHAT POWER? WHAT PRICE?
All you need to know about BULBS

<table>
<thead>
<tr>
<th>CLEAR BULBS</th>
<th>Type</th>
<th>Cap</th>
<th>Price</th>
<th>Flash duration (milliseconds)</th>
<th>Time to peak</th>
<th>Lumen secs.</th>
<th>Guide No. FP 3 1/30</th>
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<tbody>
<tr>
<td>PF 1</td>
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<tr>
<th>BLUE BULBS</th>
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<th>Cap</th>
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<th>Flash duration (milliseconds)</th>
<th>Time to peak</th>
<th>Lumen secs.</th>
<th>Guide No. Kodachrome 1/30</th>
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<tbody>
<tr>
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Practical Photography
**ALL ABOUT FLASH**

**WHAT TYPE?**
**WHAT POWER?**
**WHAT PRICE?**

All you need to know about **MAZDA BULBS**

### CLEAR BULBS

<table>
<thead>
<tr>
<th>Type</th>
<th>Cap</th>
<th>Price</th>
<th>Flash duration (milliseconds)</th>
<th>Time to peak</th>
<th>Lumen secs.</th>
<th>Guide No. FP 3 1/30</th>
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### BLUE BULBS

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<td>10,000</td>
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<tr>
<td>MF 1B</td>
<td>Capless Zirconium</td>
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<td>10d.</td>
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<td>20</td>
<td>10,000</td>
<td>50</td>
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</table>

**All you need to know about G.E.C. OSRAM BULBS**

(MADE IN GERMANY)

### CLEAR BULBS

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<tr>
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<th>Cap</th>
<th>Price</th>
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<td>9d.</td>
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<td>8d.</td>
<td>20</td>
<td>18</td>
<td>7,500</td>
<td>42</td>
</tr>
</tbody>
</table>

**More than one bulb**

If you are using a second flashbulb as a fill-in light or as a background light, you can completely ignore it and base your exposure upon the main light only. If however, you are using two flashbulbs of equal strength and directed upon the same subject at the same distance, calculate your exposure as for one flashbulb only, then reduce your lens aperture by one stop. The basic rule is multiply the guide number by the square root of the number of flashbulbs employed. To save you working it out, if you are using two flashbulbs of the same power at the same distance multiply your guide number by 1.4, or for three flashbulbs by 1.7.

**Colour**

Ordinary flashbulbs are clear in colour, and are intended for use with black and white materials. Their colour temperature, which is 3,800°K. is unimportant, but for colour work the precise colour of the light emitted by the bulb as distinct from its quantity is of utmost importance. For daylight colour film it must approximate very closely the colour of daylight. Consequently, you must use a blue tinted flashbulb which has a colour temperature of approximately 5,500°K., very similar to that of daylight, to get correct colour rendering.

Mazda and G.E.C. designate their blue bulbs with the letter B after the number. For instance a No. 1 bulb is white and a No. 1B is blue. With Philips, the designation /97 comes after the bulb, for instance a PF 1 is a white bulb, and a PF 1/97 is a blue bulb. Prices are generally 1d. or so extra for the blue bulbs, but the system of using them is precisely the same.

Whether you are using black and white film or colour film, whether you are an absolute beginner or an enthusiast of many years standing, flash has an essential place in your photographic armoury. It will get you pictures where otherwise lighting conditions would prevent you from getting any result, it will extend your photographic season to 12 months of the year, and it will provide you with a convenient, easy to use source of bottled sunshine.