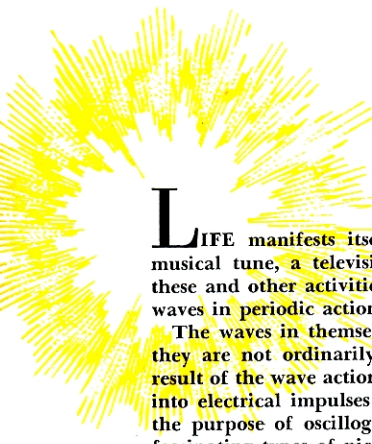


H. J. FRITZSCH

Oscillographic  
Photography



**L**IFE manifests itself through the motion of waves. A musical tune, a television picture, the beating of a heart—these and other activities are brought to our consciousness by waves in periodic action.

The waves in themselves are mechanical actions. Although they are not ordinarily visible to the eye—all we see is the result of the wave action, not the wave—we can translate them into electrical impulses and then make them visible. This is the purpose of oscillographic photography, one of the most fascinating types of picture taking.

Oscillograms are photographic records of electrical impulses on the viewing screen of a cathode ray tube. The cathode ray tube is the device used to make the electrical impulses visible to the eye. It is a special type of vacuum tube in which electrons are concentrated into a beam. This beam, electrically, magnetically or both, is directed at a specially prepared screen at one end and inside the tube. The screen becomes fluorescent at the point of impact of the electron beam and makes visible the pattern or image of the electrical impulses being studied.

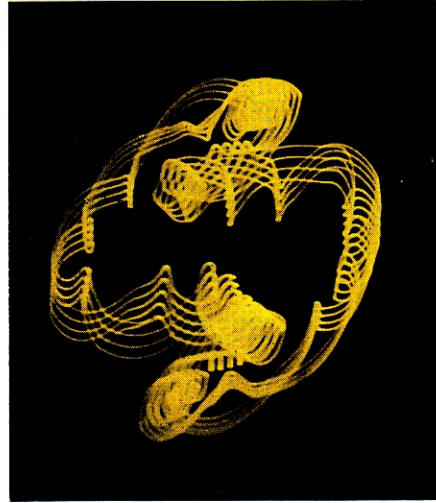
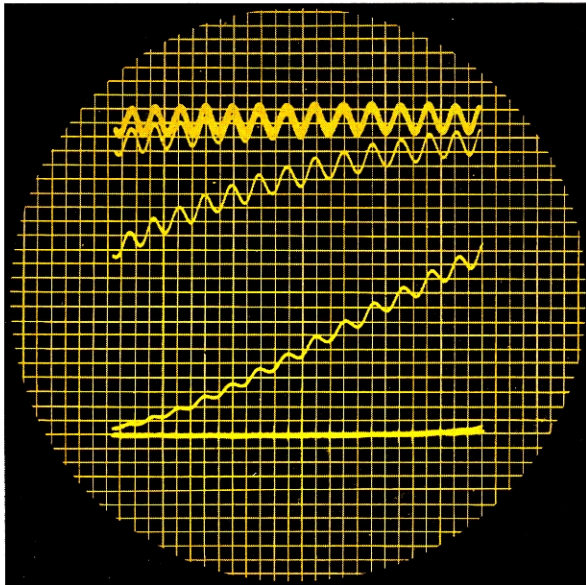
There are a thousand and one uses for oscillograms and more being found every day. In medical research, oscillograms are used to measure the activity of the brain, nerves, heart and other muscles. The oscillogram has widespread use in industry, in navigation, in radar.

Radio and television engineers trace defects and faulty designs in equipment by means of such pictures. Other craftsmen like piano tuners and watchmakers make use of this modern device to check the accuracy of their work.

Waves have personality and form. Each wave is different and each represents a challenge to the photographer's imagination and technique.

Oscillograms can be taken without any difficulty and without much additional or elaborate equipment by any Exakta owner. The first thing you'll need, of course, is an oscillograph, the apparatus that translates the electrical impulses into fluorescent images on the cathode ray tube screen.

*These waves show the light output of a projection lamp. The viewing screen grid (end of the cathode ray tube) of the oscillograph is visible in the picture.*



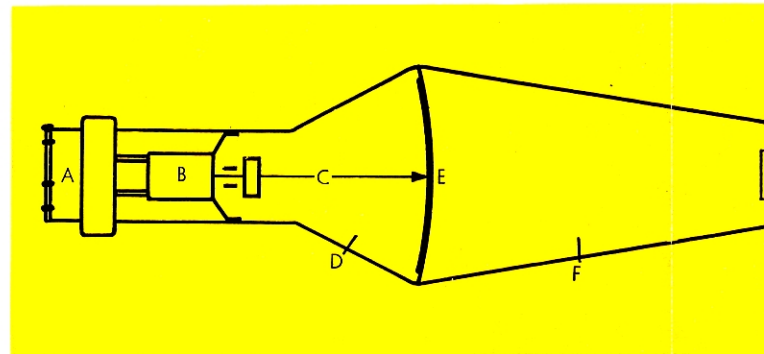
*The concentric waves of the oscillogram at the left look like a modernistic drawing, but are more than just a pretty picture. Industrial firms use such oscillograms to check products and equipment. For example, the oscillogram at the right shows turntable vibration. Medical researchers use oscillograms to check nerve reactions and other body functions. Piano tuners use them to make certain instruments are tuned properly. The commercial applications of oscillography are growing but are still relatively unexplored. Any Exakta owner can make wonderful ones like these with little extra equipment.*

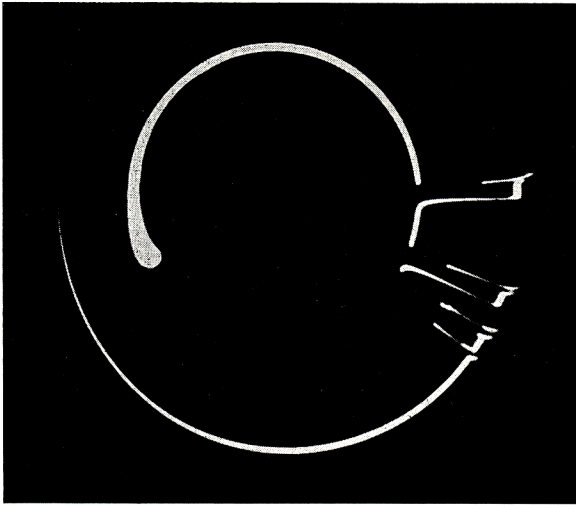
The 35-mm. Exakta is the ideal camera for oscillographic photography for several reasons. In addition to the fact that the film is inexpensive and 36 exposures can be taken on a roll, the single-lens reflex feature of the Exakta permits the process to be simplified almost to the snap-the-shutter routine.

To understand why the Exakta is the ideal camera, let's examine the problems in oscillographic photography. To begin with, there is the cathode-ray tube.

The objective, of course, is to photograph the screen as clearly as possible. This means that the camera must be close; in other words, that extension tubes must be used. All light except that coming from the screen must be excluded because reflections and side lighting degrade the image. Therefore, the camera must be linked with the screen by means of a light-tight tube that at one end covers the screen and at the other end the camera lens.

This being achieved, the problem of being able to focus, compose and see when to snap the picture arises. Oscillographic photography is impossible with a camera lacking a ground glass because there is no way to make certain that you are in focus and that your picture is properly composed with such a camera. If a view or other type of sheet-film camera is used, there is the bother of focusing, then inserting film holders and not being able to see the screen at the moment of exposure. A camera that has separate optical systems for viewing and taking the picture also is complicated to use because of parallax and other difficulties arising when the camera is used close to the oscillograph. With an Exakta, however, the light-tight tube and camera can remain in place and you can focus, compose your exact picture and see it up to the instant you trip the shutter. It's so simple with the Exakta, that other methods are discouraging by contrast.





To take oscillograms with the Exakta, it is necessary to use a paper cone or tube to exclude all light except that coming from the oscillograph screen. One end of the cone is placed against the screen, the other end surrounds the camera lens (see set-up in diagram below).

It may also be advisable to use extension tubes in order to increase the scale of the image. In most cases, the combination of the rear and front adapter rings alone will be sufficient. This will give you a ratio of 1:5.8; the image on the film will be 1 inch if the actual oscillographic picture is 5.8 inches. You can vary the scale of the image by using the 2-in-1 adapter ring and additional extension tubes. (More information on this type of photography will be found in the Exakta publication, *Hyperclose-up Photography with the Exakta*, available from Exakta Camera Company or your dealer.)

The simplest oscillographic pattern to photograph is the stationary one. The image recurs from cycle to cycle without change, so all you have to do is open the camera shutter long enough to record one complete sweep. If the shutter is closed before the cycle is completed, part of the pattern will be missing. Aside from this minimum shutter time, neither length of exposure nor aperture setting are critical. Overexposure merely increases the image line width.

Technique is more important when you photograph a continuously varying pattern. For such subjects, shoot several exposures at various speeds.

An exposure meter with a photoelectric cell will provide an accurate exposure setting quickly and simply if the Ihagee Magnear viewfinder is used on the camera instead of the standard waist-level finder.

Generally, the exposure runs between 1/25 and 1/2 of a second. It depends, however, upon the speed of the electronic

beam, the amount of time the screen retains the image, the amount of light produced by the screen, the speed of the film being used, the speed of the lens, the aperture of the lens and the length of the extension tube. Sometimes the screen retains the image too long and a blue filter must be used. This filter also affects the exposure.

Depth of field is not a problem usually in oscillographic photography. Since you are shooting a screen, it is necessary to stop down only enough to cover any errors in focusing. The aperture of the lens should usually depend upon the length of exposure required to give you the pattern you want.

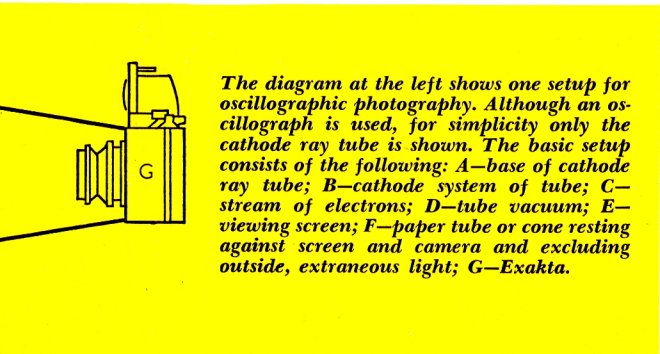
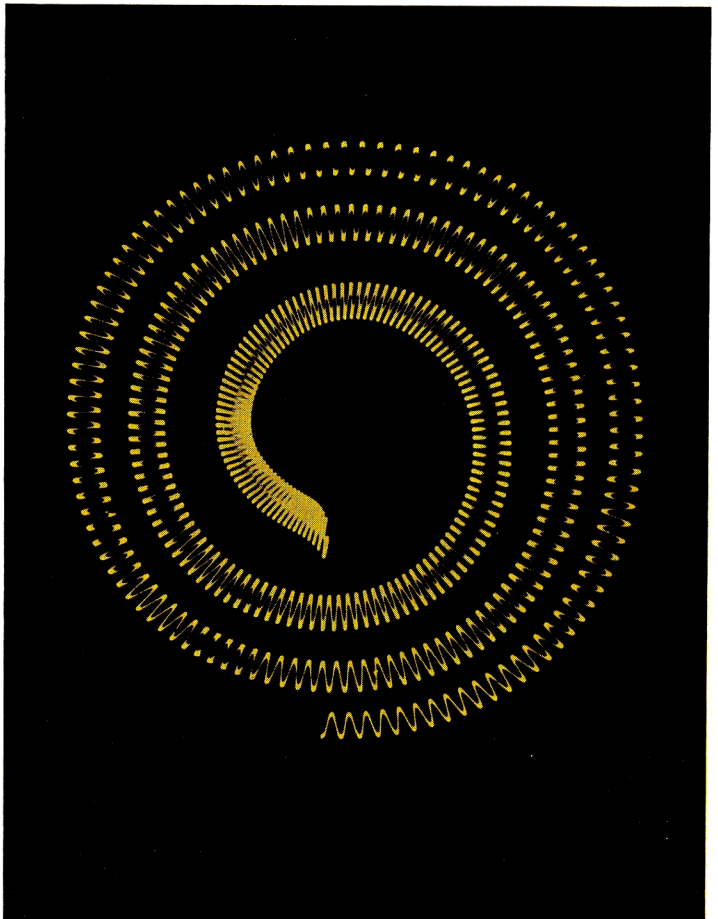
Although it is possible to use any Exakta lens for oscillographic photography, the standard, 50-mm., f/3.5 Tessar or newly designed 50-mm., f/2.8 Tessar is preferable. Longer lenses require that the distance between lens and screen be greater, while faster lenses do not furnish as fine definition.

Many problems of oscillographic photography can be simplified by the choice of the proper film. The oscillographic screen usually is between yellowish green and blue in color, depending upon the lighting substance of the cathode-ray tube. The fastest possible film should be used. Panchromatic film (sensitive to red and yellow) is preferable. Orthochromatic (sensitive to blue and green) and blue-sensitive film may be found advisable when it is necessary to avoid image persistence or yellow light. The fastest recording emulsions for oscillographic photography are Linagraph Pan and Linagraph Ortho.

The film should be developed in a rapid developer so that hard negatives are obtained for better contrast. Standard processing for 35-mm. film in a developer such as D-76 will yield fine-grain oscillograms. Development time is not critical because very little density range is required and grain is no problem. High-speed oscillograms should have prolonged development in a developer such as D-19.

Undesired illumination sometimes causes fogging of the negative. In some instances, it can be eliminated by reduction.

*This spiral represents a low-frequency wave of 20-second duration. Such oscillograms, naturally, must be taken with a time exposure. The duration of the exposure depends upon the coverage required.*



The diagram at the left shows one setup for oscillographic photography. Although an oscillograph is used, for simplicity only the cathode ray tube is shown. The basic setup consists of the following: A—base of cathode ray tube; B—cathode system of tube; C—stream of electrons; D—tube vacuum; E—viewing screen; F—paper tube or cone resting against screen and camera and excluding outside, extraneous light; G—Exakta.



## PORTRAIT OF A VILLAIN

The little black-and-white splat above that looks like spilt milk is Exhibit A, a dastardly villain of the first rank. This scoundrel, an electronic "bug," cuts up quite a few monkeyshines in plant operations. It was "mugged" by photographing the image right off the end of a cathode ray tube of an oscillograph. Industry has found the Exakta an indispensable tool for bringing such invaders into the open where they can be studied and eliminated. Industry also has found a thousand and one other indispensable uses for the Exakta. For instance, it can be used for inspection of products, checking repairs, copying documents, making progress and other records, microfilming files, taking product photos, employe identification pictures, stress and strain investigations, time and motion studies, photographing inaccessible parts, cataloging, publications and publicity. The Exakta also has an important role in product research, in making visual aids for sales presentation and training programs and in general laboratory work. Wherever industrial photography has reached the professional level, you will find the Exakta one of the most highly valued tools of management because it is the most versatile camera in the world. We invite you to write us for more information on the Exakta and how it can be used in your field.

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