THE OSCILLOGRAPHER

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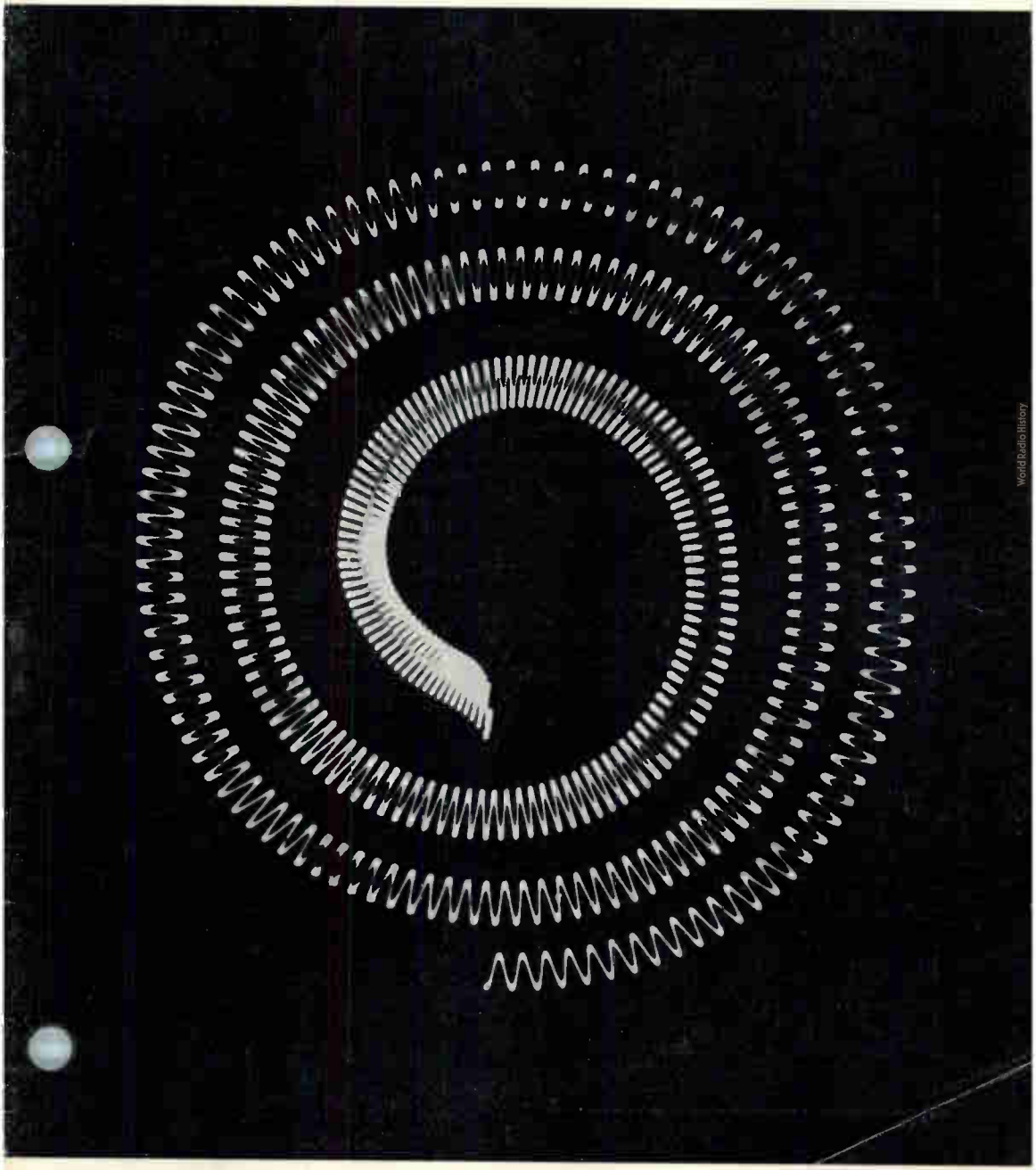

SPIRAL TIME BASE

SEE PAGE 2

The Instrument Service Department

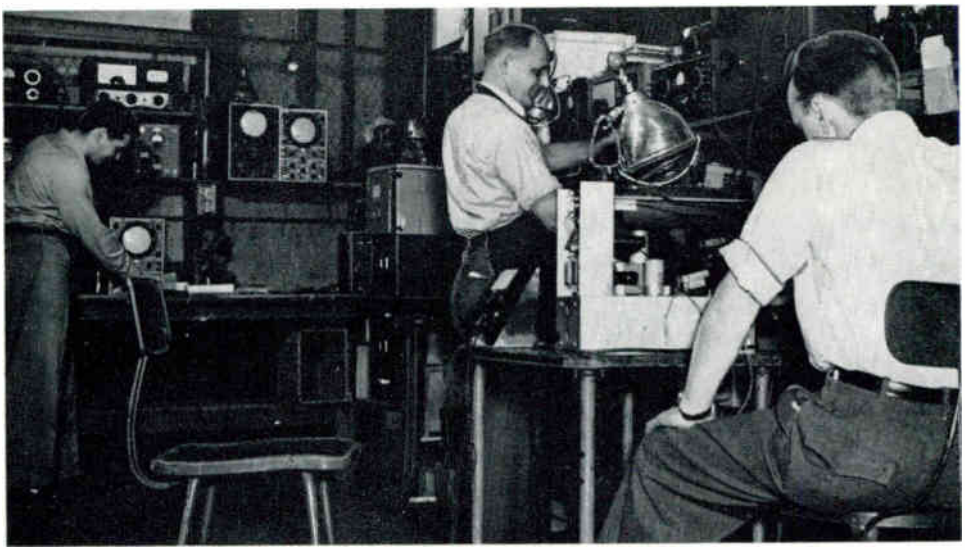

Figure 1. A portion of the Du Mont Instrument Service Depot at Clifton, New Jersey.

For as long as Allen B. Du Mont Laboratories has been producing equipment for cathode-ray oscillography, a guiding principle has been the realization that a manufacturer's responsibility to the customer does not end with the sale or delivery of the merchandise. In line with this policy the Instrument Division maintains a well equipped and well staffed Service Department with Service Depots located at the following strategic points throughout the country:

J. T. Hill Sales Company
800 West 11th Street
Los Angeles 15, Calif.

(*Continued on Page* 12)

THE OSCILLOGRAPHER

A publication devoted exclusively to the cathode-ray oscillograph, providing the latest information on developments in equipment, applications, and techniques. Permission for reprinting any material contained herein may be obtained by writing to the Editor at address below.

Published quarterly
by
Allen B. Du Mont Laboratories, Inc.
Instrument Division
1000 Main Ave.
Clifton, N. J.

Neil Uptegrove - Editor

ON THE COVER

Aside from its asthetic appeal, this oscillogram illustrates the use of the spiral trace for creating a time-base of great length. In this instance, a low-frequency audio signal has been impressed on an uninterrupted trace having a duration of 20 seconds.

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New Equipment for Single-frame

PHOTO-RECORDING

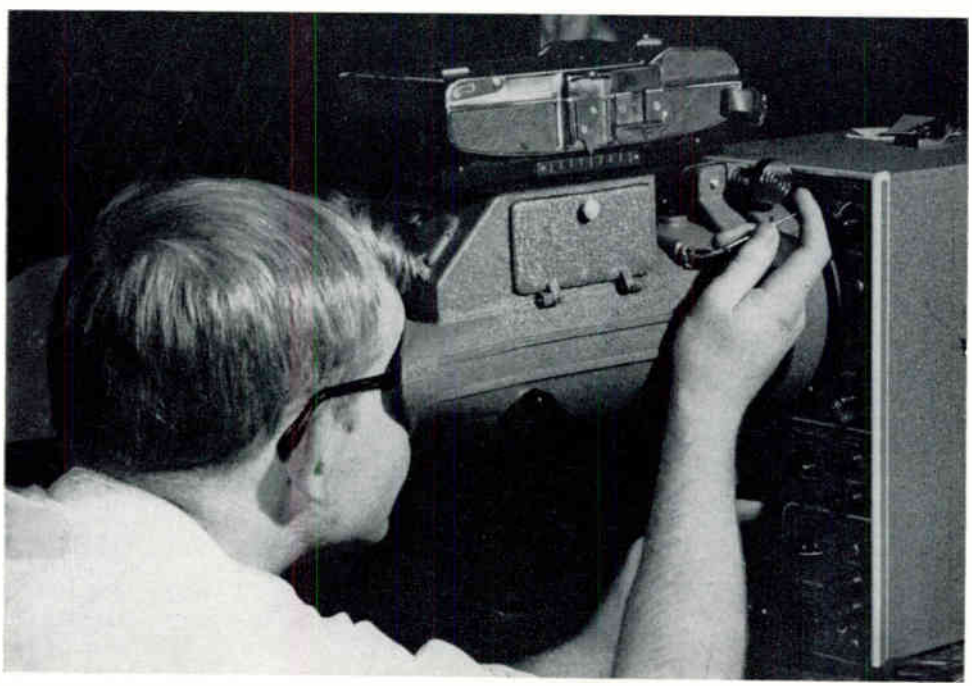
INTRODUCTION

Early in the development of the art of photographic recording from cathode-ray tubes, Du Mont Engineers recognized the fact that, in this highly specialized field, conventional photographic equipment was inadequate if optimum results were to be obtained. Even the finest commercially available cameras were not particularly well suited for oscillographic recording. Many of the features of good commercial cameras were useless, or even impeded recording, thus serving only to impose a wholly needless increase in the cost of the equipment.

For example, shutters such as the rapid-compur type or the focal-plane type, usually found in cameras of good quality, are unnecessary, since most oscillograph-recording exposures are "Time" or "Bulb", with very few as fast as 1/30-second. Actually, these shutters, which require winding before each exposure, merely add one step to the process of recording, while contributing nothing to the quality of the oscillogram which could not be achieved with a simple, self-winding shutter.

The variable-focus lens, a feature of virtually all conventional cameras, complicates recording considerably, since the lens must be focused with great care every time the camera is set up, and the focus must be checked frequently during subsequent recordings. Built-in range-finders, often found in commercial cameras, offer no advantage in this application. Similarly, accessories such as built-in exposure meters, flash synchronizers, exposure delays, etc., increase the cost of the equipment, and add nothing to the convenience or quality of recording.

Figure 1. Making a recording with the Du Mont Type 297 Oscillograph-record Camera.



On the other hand, there are a number of features, not generally found in conventional photographic equipment, that contribute greatly to the ease and efficiency of oscillographic photography.

For example, if the optimum writing-rate capability of the camera is to be realized, the screen of the oscillograph should be photographed in total darkness, since ambient light on the face of the cathode-ray tube reduces pattern contrast. Total darkness at the screen can be achieved most conveniently by use of a light-tight hood between the camera and the fluorescent screen. Provision should be incorporated in such a hood to enable viewing the pattern during exposure, so that the entire process may be properly monitored.

A camera for oscillograph recording should include a means for mounting it on the oscillograph. This mounting should be simple, enabling rapid attachment or removal of the camera, and it should not interfere in any way with the controls of the oscillograph.

The early oscillograph-record camera was thus conceived as a simple camera, consisting of a light-tight film carrier, a good-quality, fixed-focus lens, and a simple, self-cocking shutter. The problems of attaching the camera to the oscillograph, shielding ambient light from the screen, and establishing positively the correct distance for the fixed-focus lens were solved at once by the use of a rigid metal extension barrel fixed to the camera unit, and clamping against the front of the oscillograph.

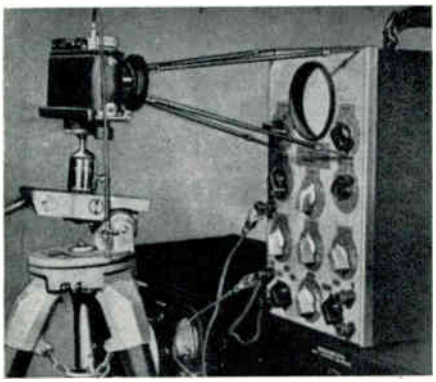


Figure 2. An early arrangement for making photographic recordings. The equipment for such a set-up was more expensive than present oscillograph-record cameras, and was by no means as efficient.

In this form, the first Du Mont oscillograph-record camera, the Type 271-A, came into use.

The prime function of early oscillographic cameras was simply to obtain a permanent, accurate record of the phenomenon under investigation. However, with the increase in efficiency of recording made possible by a camera specifically designed for this application, it became apparent that many vital details could be observed on recordings, which escaped notice during visual observation. This was particularly true in the case of non-repetitive signals, where it was extremely difficult, even with long-persistance phosphors, to study patterns in any detail directly from the screen. Thus the oscillograph-record camera ceased to be merely a convenient accessory, and began to assume the role of an essential equipment for many phases of oscillographic investigation. However, as the state of the art of cathode-ray oscillography progressed, it was apparent to Du Mont engineers that more advanced equipment would be required to meet the ever increasing demands of present and obvious future applications. Equally apparent was the fact that with the increasing diversity of recording applications, no single recording device could be expected to serve efficiently and economically over the entire range of problems. Thus Du Mont divided single frame recording operations into 3 general catagories:

(1) Economical, general-purpose recording

(2) Ultra-high-speed recording

(3) Finished-print recording

In order to provide a complete line of oscillograph-recording equipment, Du Mont has developed 3 new single-frame oscillograph-record cameras, each designed specifically for one of the above mentioned catagories.

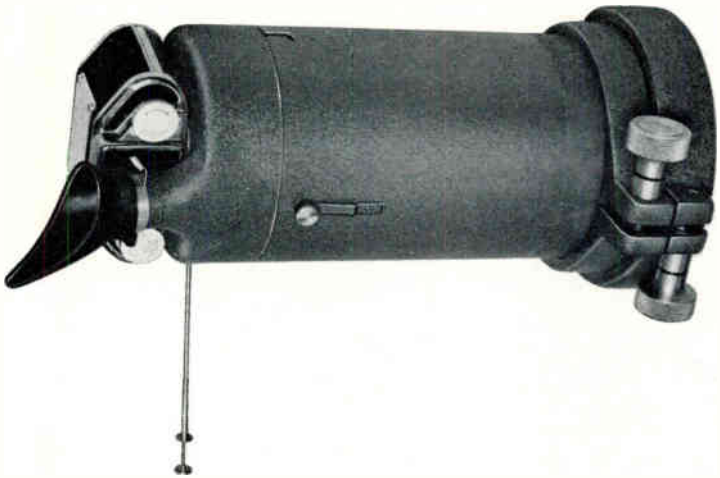


Figure 3. The Du Mont Type 296 Oscillograph-record Camera. This new camera has been specifically designed for economical, general-purpose single-frame recording. This camera, like the Du Mont Types 295 and 297 may be used with any standard 5-inch oscillograph.

Economical General-Purpose Recording

This category embraces the vast range of recording applications, including photography of repetitive patterns as well as low- and medium-speed transients. The new Du Mont Type 296 Oscillograph-record Camera was designed to meet the needs of this type of recording economically, conveniently, and efficiently.

The Du Mont Type 295 Oscillograph-record Camera

The Type 296, directly replacing the Du Mont 271-A is a basic camera, consisting of the camera body with lens and shutter, the housing which adapts the camera to the extension barrel, the extension barrel, and the clamp ring by means of which the entire assembly is fixed to the bezel* of the oscillograph. The clamp ring permits rapid, convenient mounting and dis-mounting of the camera without interfering in any way with the controls of the oscillograph. While attached, the camera is held firmly in place, and adjustments of the camera's controls may be made with no danger of dislodging the clamp ring. No additional support for the camera is required.

In designing a camera for this range of application, dependability, simplicity of operation, and versatility together with economy were considered to be of prime importance. Dependability has been achieved in the Type 296 through careful design and construction throughout. For example, the clamp ring, extension barrel, and housing of the Type 296 are of cast aluminum, providing an extremely rugged and durable assembly. The camera back is a standard Bolsey Model B, modified to adapt it to this purpose. This camera is a sturdy precision, aluminum die-casting. Aside from providing great mechanical strength, the all-metal construction of the Type 296 permits the entire assembly to be grounded, thus eliminating the danger of static fogging of the film when the camera is used to record from cathode-ray tubes operated at high accelerating potentials.

The shutter of the Type 296 is of extremely simple design, and is of the self winding type. It provides exposures of "Time" and "Bulb", in addition to a range of shutter speeds. This simple type of shutter is all that is required for oscillographic photography, and so it contributes materially to the simplicity and economy of the Type 296. Accurate synchronization of a mechanical shutter with an electrical phenomenon is quite difficult. Thus in practice, records are nearly always made with the shutter in "Bulb" position, while

* All Du Mont Oscillograph-record Cameras are designed for mounting on the Du Mont Type 2501 Bezel. If these cameras are to be used with oscillographs not equipped with this bezel, the Type 2501 Bezel may be purchased separately.

timing, if any further timing is required, is provided by the phenomenon that is recorded.

Simplicity of operation is achieved in the Type 296 by holding to a minimum the number of controls. The Type 296 is a basic camera requiring no adjustments other than those for shutter speed and aperture setting.

Versatility of the Type 296 has been substantially increased over its predecessor by the use of a faster f/2.8 lens. The f/2.8 Wollensak, coated, Raptar lens enables the Type 296 to record writing rates in excess of 10 inches per microsecond from a P11 screen with the cathode-ray tube operated at an overall accelerating potential of 12,000 volts. This represents an increase in writing rate capability by a factor of nearly 2.

A convenient feature of the Type 296 is the rubber eyepiece fixed to the viewing port provided in the extension barrel. This permits comfortable viewing of the cathode-ray screen during recording. The rubber eyepiece is sufficiently flexible that it may be used with ease by an operator wearing eye glasses.

SPECIFICATIONS

Camera back: Modified Bolsey Model B 35-mm camera body, mounted on aluminum casting.

Lens: f/2.8, 41.5mm. Wollensak, Raptar coated lens mounted in a number 0 Alphax shutter.

Shutter speeds: Time, Bulb, 1/200, 1/100, 1/50, 1/25, and 1/10 sec.

Object to Image Ratio: 5.

Maximum Photographic writing speed: Not less than 10 inches per microsecond with P11 screen at 12,000 volts accelerating potential.

Viewing: Viewing aperture with soft-rubber eye shield and shutter blade to close aperture when not in use.

Barrel Extension: Easily clamped to any cathode-ray oscillograph by means of clamp ring. Barrel makes excellent light shield when camera is detached.

Approximate Physical Dimensions:
Overall length: 11⅜ inches
Diameter: 4¾ inch barrel
Weight: 4½ pounds
Finish: Du Mont blue-grey wrinkle

Catalog Number 1427-E Price $149.50

ULTRA-HIGH SPEED RECORDING

Frequently during the oscillographic investigation of signals containing high-frequency components, writing rates are encountered which are beyond the recording capabilities of general purpose oscillograph-record cameras. This is particularly true in the case of high-frequency signals occuring as single transients or having extremely low repetition rates, where there is little or no "build-up" of light resulting from successive traces.

Figure 4. The new Du Mont Type 295 Oscillograph - record Camera is intended for recording of ultra-high - speed phenomena. With this Camera, writing rates as high as 150 inches per microsecond may be recorded from a P11 screen, with 12,000 volts acceleration.

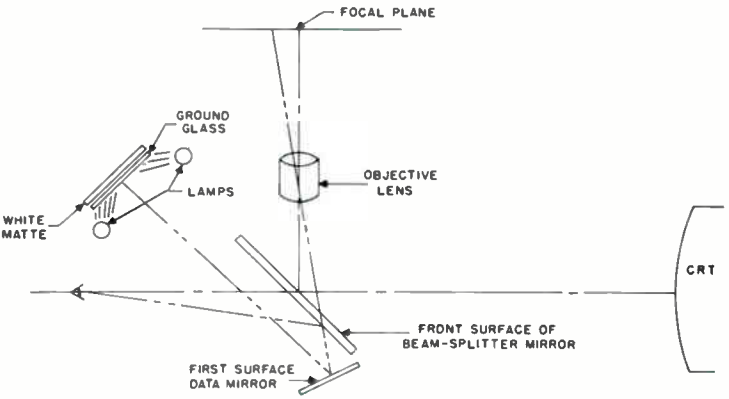


Figure 5. Diagramatic sketch of the optical system of the Type 295. Use of mirrors permits more compact construction of camera by folding the light path to the focal plane. Same arrangement is used in the Du Mont Type 297 Oscillograph - record Camera.

To provide equipment for the recording of such high-speed phenomena, Du Mont has developed the new Type 295 Oscillograph-record Camera. (See Figure 4.)

Du Mont Type 295 Oscillograph-Record Camera

The ideal optical system for a camera for such recording applications was conceived as one which would provide usable image densities for the most rapid writing rates encountered in cathode-ray oscillography on commercially available emulsions, using standard processing solutions. This optical system should also be capable of recording without distortion the oscillographic pattern as it appears over the useful area of the fluorescent screen. Obviously, a limiting factor of this requirement is the cost of the lens. Generally speaking, the greater the aperture of the lens, the higher the cost will be for a given degree of correction. The cost of a large-aperture objective can be kept down by using as short a focal length as possible. This limits the size of the image that can be obtained and indicates that the highest writing rate per unit cost (this might be expressed in inches per microsecond per dollar) can be obtained by the use of 35-mm film.

Before a lens was selected for the Type 295, a number of lenses, supplied by manufacturers in the United States and abroad, were tested and evaluated. The objective finally chosen was an f/1.5, 50-mm Wollensak Raptar lens. With Eastman-Kodak Linagraph Pan film, this lens is capable of recording writing speeds as high as 150 inches per microsecond when used with high-voltage instruments. The camera has also been designed to allow the use of the fastest 50-mm objective manufactured specifically for cathode-ray tube recording. This is the Wray

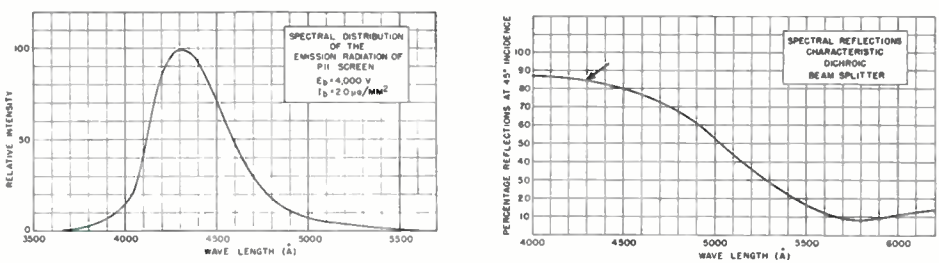


Figure 6. The graph at left shows spectral distribution of the light output of the P11 screen. Graph at right indicates the spectral reflection characteristic of the beam-splitting mirror employed in the Du Mont Types 295 and 297 Oscillograph-record Cameras. Arrow in graph at right indicates point of maximum output of P11 screen.

Figure 7. Type 295, with access port open, permitting adjustments of aperture setting. Data card, over viewing port, provides convenient means for recording pertinent information directly on oscillogram. Knob below access port controls mask to close viewing port when in use. Over access port are, from right to left, film-advance knob, frame-counter re-set knob, frame counter, and shutter release.

f/1.0, 2-inch cathode-ray tube copying lens designed by Wray Optical Works, Ltd.*

For greatest convenience, it should be possible to remove an individual frame or series of frames for immediate processing after exposure, without first either finishing the entire supply of film, or wasting most of the roll. The Type 295 is equipped with a specially designed take-up cassette having a built-in cut-off knife and light trap. This cassette enables the removal of short lengths of 35-mm film in the light-tight take-up cassette without removing the cover of the camera.

The Type 295 employs a friction drive for film advance, rather than the more conventional sprocket drive. This type of advance provides several advantages. First, such an advance mechanism simplifies the problem of obtaining film, since either perforated or unperforated 35-mm film may be used, or sheet film, cut into 35-mm sheets may be employed.

Second, the film advance system of the Type 295 enables the operator to take advantage of most new emulsions as soon as they become available, since new emulsions are most frequently available only on sheet stock.

The Type 295 employs a square focal-plane opening, rather than the conventional rectangular one. This feature enables the Type 295 to yield 40 exposures on a standard 36-exposure length of film.

One difficulty frequently encountered in photographic recording is that of conveniently observing the cathode-ray tube screen while photographing the pattern. The ideal oscillograph-record camera should provide binocular viewing with the eyes at a distance from the cathode-ray tube which enables the best vision, and with a direct view of the cathode-ray tube. This has been accomplished in the Type 295 by the use of a beam-splitter mirror which reflects the photographically useful light to the camera, while transmitting a sufficient amount of the remaining light from the cathode-ray tube to permit satisfactory visual observation of high-speed transients. The mirror also folds the light path to the camera, permitting a more compact construction of the entire assembly. The diagram of Fig-

* This lens is recommended in extreme cases of high-speed transient recording when other methods for increasing the effective speed are unsatisfactory. Additional information concerning the use of the Wray lens may be obtained by writing to the Instrument Division of Allen B. Du Mont Laboratories, Inc., at the address given on page 2.

ure 5 is a representation of the optical system of the camera. The beam-splitter chosen for this design is a dichroic, or interference-type, mirror. It is constructed by careful evaporation of quarter-wave length films upon a sheet of clear glass. When held at a 45-degree angle, the spectral reflectivity curve of the mirror closely resembles the spectral characteristic of a Type P11 screen (See Figure 6). The most important advantage of this type of mirror over the usual first-surface, partial-reflecting mirror is that it has practically no absorption. Photographic measurements of the dichroic beam-splitter show that it reflects 78% of all the photographically useful light from a P11 screen when using panchromatic film. With orthochromatic film the percentage of photographically useful light reflected is approximately 85%. For comparison, similar measurements were made with total-reflecting first-surface mirrors (not beam-splitters) showing that 85% of the photographically useful light is reflected. Thus, the dichroic mirror, which reflects the blue-violet portion of the light and transmits the red-yellow, is comparatively very efficient and is the most practical beam-splitting mirror presently available for this purpose. It is apparent that the loss of approximately 7% of the photographically useful light through employment of the dichroic mirror is completely inconsequential in comparison with the large number of variables, undeterminable within very substantially greater error, that affect the maximum photographic writing speed of an oscillograph-record camera.

Built-in Data Card

A great convenience in recording is a provision for the recording of pertinent data, simultaneously, if possible, on the same frame as the oscillogram. The diagram on Figure 5 shows how this is accomplished in the Type 295. The Type of data-recording system employed in the Type 295 makes it possible to record either handwritten data, a digital counter, or any other object, such as the face of a watch, etc. The white matte surface provided on the hinged door of the data card on which the necessary data is written is illuminated by two small lamps that draw power from a size C leak-proof flashlight battery built into the data-card compartment. A push-button switch on the side of the data-card assembly permits momentary exposures of the data card, and also insures that the switch will not be left on accidentally, draining the battery. The diagram of the optical system shows a small, first-surface mirror in the data-card system. Its purpose is to enable placement of the data-card surface at the most convenient point, to provide the proper optical distance so that the data card is in focus, and to provide the same inversion of the data card image as is obtained with the cathode-ray pattern. When a recording made with the Type 295 is observed or printed, the negative should be held with the emulsion in the opposite direction from that in which it would normally be held. Both the data-card image and oscillogram then print correctly.

In using an oscillograph-record camera with high-voltage oscillographs, it is often desirable to provide some sort of automatic beam-control switch, which operates simultaneously with the shutter. The Type 295 is equipped with such a switch and a connector to which a relay may be wired, either for the purpose of brightening the cathode-ray tube trace only while the shutter is open, or for interlocking a piece of equipment, such as an impulse generator, to prevent its being triggered before the shutter is open.

It should be noted that the entire camera is fabricated from metal. Aside from providing great mechanical strength, this all-metal construction permits the entire camera to be grounded to the oscillograph. Thus is eliminated danger of fogging the film as a result of static charge when the camera is employed with a high-voltage cathode-ray oscillograph.

Finally, a simple mounting system is accomplished by the same type of sturdy clamp ring used with the Type 296. And, as in the case of the Type 296, no additional support of any kind is required.

SPECIFICATIONS

Camera Back: Specially designed camera with friction drive, film counter, removable take-up cassette with cut-off knife, built-in shutter and provision for remote operation. All-metal construction with stainless-steel pressure plate.

Lens: f/1.5, 50mm. Wollensak Raptar mounted in barrel with iris diaphragm and "click" stops. Provision for use of Wray f/1.0, 2-inch cathode-ray tube copying lens for highest possible photographic writing rates when desired.

Object to Image Ratio: 4.4.

Shutter: Wollensak blade movement built into camera body, provides exposures of "Time" and "Bulb".

Maximum Photographic Writing Rate: 150 inches per microsecond at 12,000 volts accelerating potential.

Mirror Housing: Contains dichroic, beam-splitter mirror for binocular viewing; sturdy casting easily clamps to any oscillograph; comfortable eye shield.

Film Supply: Takes standard 35-mm cassette, 40 exposures on standard 36-exposure roll. Frame counter, counts to 40 exposures. 35-mm perforated or unperforated film or recording paper may be employed.

Film Drive: Friction type to allow use of perforated or unperforated 35-mm film or paper; keyed shaft permits remote operation.

Shutter-interlock Switch: Permits interlocking electrical equipment with shutter or automatic control of cathode-ray tube beam.

Data Card: Built into mirror housing with two miniature lamps, self-contained battery, push-button switch for momentary exposures. Data may be inscribed in pencil on white, matte surface on hinged, data-card cover. Small front-surface mirror insures data card to be in perfect focus. Data may be recorded simultaneously with oscillogram.

Catalog Number	Price
1550-E	$495.00

FINISHED-PRINT RECORDING

Under certain circumstances, it is necessary or convenient to obtain a finished oscillogram with the least possible delay. This need might arise, for example, in circuit development work, where step-by-step progressive recordings of the effect of circuit changes are to be recorded for immediate comparison, as well as permanent documentation.

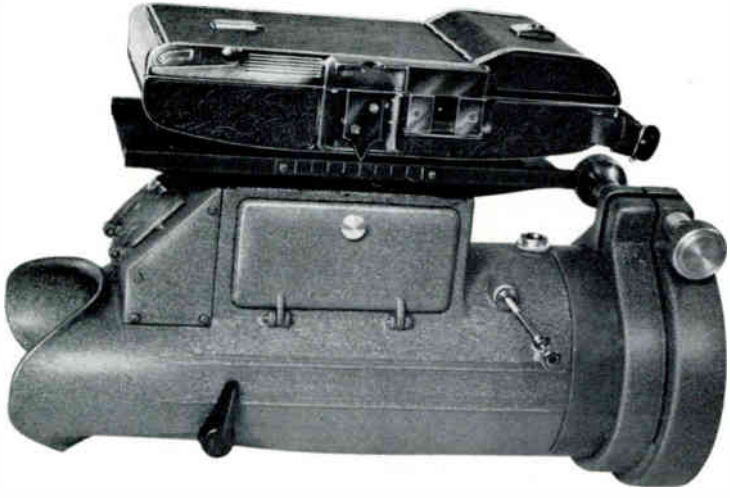


Figure 8. The new Du Mont Type 297 Oscillograph - record Camera. Note that the main housing is similar to that of the Type 295. The Type 297 produces a finished print in 60 seconds after exposure.

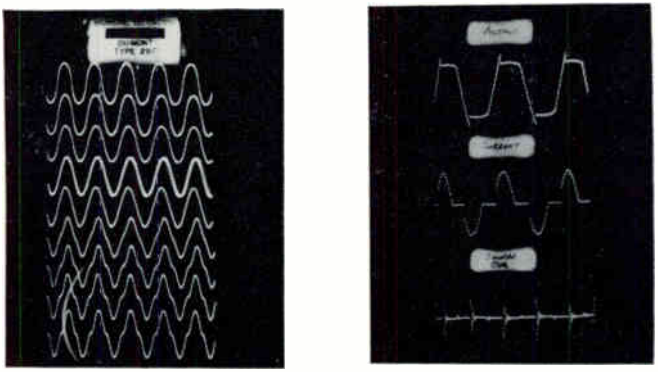


Figure 9. Two oscillograms taken with the Type 297. Oscillogram at left was made by multiple exposure, using slide and pointer to locate traces. Multiple-exposure oscillogram at right was made by using the three detented stops on slide.

Du Mont Type 297 Oscillograph-record Camera

The Du Mont Type 297 Oscillograph-record Camera has been designed to meet this need. Operating on the Polaroid-Land principle, the Type 297 produces a finished oscillogram 60 seconds after exposure.

The housing employed by the Type 297 is similar to that of the Type 295, and provides the same conveniences, such as the illuminated data card and binocular viewing (See Figure 8).

The camera back of the Type 297, is, as in the case of the Type 295, mounted on top of the mirror housing, out of the operator's way. A sliding adaptor attaches the camera back to the housing. The adaptor consists of two precision-machined castings, one of which slides inside the grooves of the other. This sliding action enables the operator to take a number of recordings on a single frame. The sliding mechanism also contains three detented stops which can be used to locate rapidly three equally spaced oscillograms, as in Figure 9. A pointer and scale indicate a total of nine equally spaced positions for exposure, while a captive screw locks the mechanism in any position. This feature is extremely useful when a close comparison of a series of consecutive oscillograms is to be made. The successive oscillograms, appearing one below the other and closely spaced, make it possible to detect minute changes occuring in a phenomenon. The whole assembly may be carried by the strap on the camera if this mechanism is locked.

An important advantage of the design of the Type 297 is that the camera back

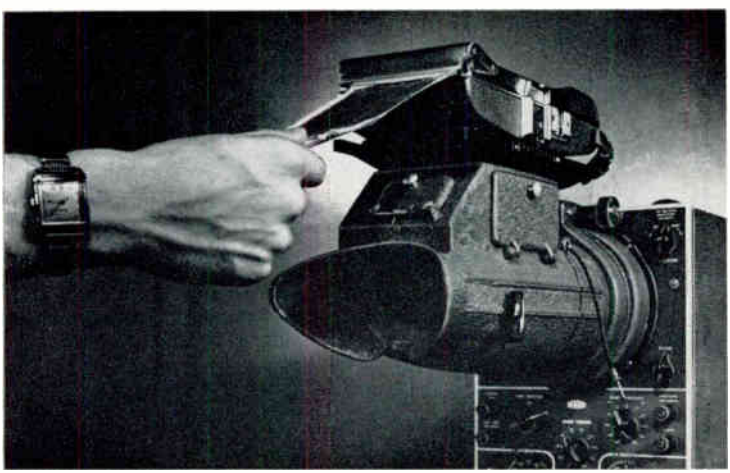


Figure 10. The camera back of the Type 297 is mounted in the most convenient position for pulling the film tab. The clamp ring holds the camera firmly to the oscillograph so that there is no danger of dislodging it during the film-advance operation.

mounts in the most desirable position for pulling the end tab of the Polaroid-Land film out of the back to initiate the processing. An even, firm pull is necessary to crush the container of jellied photochemicals in the Polaroid-Land material and to spread this jelly evenly over the emulsion. The clamp ring holds the camera securely, so that during this operation there is no danger of dislodging the camera. No other support, brace, or clamp is required (See Figure 10).

A Du Mont Wollensak f/2.8 lens, coated to increase light transmission, is provided with the Type 297, and enables recording writing rates of 3.5 inches per microsecond from a cathode-ray tube operated with 12,000 volts acceleration. For applications where higher writing-rate capabilities are required, the Type 297 is available with an f/1.9 lens. The f/1.9 lens permits recording of writing rates up to 7 inches per microsecond from a cathode-ray tube with 12,000 volts acceleration.

SPECIFICATIONS

Lens: Du Mont-Wollensak f/2.8, 75mm, coated.

Shutter: Wollensak Alphax; Time, Bulb, 1/100, 1/50, 1/25.

Focus: Fixed, but may be adjusted for special oscillographic work.

Print Size: 3¼ by 4¼ inches; 1, 2, 3, or more records per Polaroid-Land print.

Photographic Writing Speed: Writing rates of 3.5 inches per microsecond have been recorded consistently at 12,000 volts accelerating potential.

Cat. No.	*Description*	*Price*
1552-E	Type 297 Oscillograph-record Camera with 75mm. coated, f/2.8 lens.	$285.00
1553-E	Type 297 Oscillograph-record Camera with 75mm. coated, f/1.9 lens.	$355.00

Notice

In response to numerous requests, we have prepared the article, "Techniques of Photo-recording" which appeared in the April-June, 1950, issue of the Oscillographer, in separate bulletin form. This bulletin may be obtained from the Instrument Division, Allen B. Du Mont Laboratories, Inc., 1000 Main Avenue, Clifton, New Jersey.

INSTRUMENT SERVICE

(*Continued from Page 2*)

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E. A. Ossmann
295 Lake Avenue
Rochester 6, New York

Allen B. Du Mont Labs., Inc.
1000 Main Avenue
Clifton, New Jersey

The Du Mont Instrument Service Department has two major functions: 1) to assure fulfillment of the Du Mont Guarantee, and 2) to provide the most efficient, most convenient, and the most economical servicing of Du Mont instruments possible.

The Du Mont Guarantee

As has been noted previously on these pages, all Du Mont instruments are guaranteed to equal or exceed the specifications published for the particular Type, and are further guaranteed against defective workmanship and materials for a period of one year from the date of sale. Du Mont cathode-ray tubes are guaranteed for 1000 hours of operation or for 6 months of installation, whichever expires first. Du Mont reserves the right to limit claims on cathode-ray tubes to 9 months from the date of shipment from the factory. However, owing to the widely varying applications to which cathode-ray tubes are put, each claim will be judged on its individual merits. Broken glass, burned-out filaments, and screen burns are excepted from the tube guarantee.

Should an instrument develop a fault resulting from defective materials or workmanship, or be found not to conform to published specifications within the guarantee period, the instrument will be either replaced or repaired at no expense to the customer.

Du Mont Service

In any case where an instrument requires service, whether covered by the guarantee or not, there are several points to bear in mind and several steps to follow if the greatest efficiency and convenience of service are to be obtained:

1. On receipt of a new Du Mont Instrument the enclosed guarantee card must be completely filled out and returned to the factory. The type and serial numbers of both the tube and the instrument must be included if the guarantee is to be effective.

2. Should a fault develop, write the Instrument Service Department, Allen B. Du Mont Laboratories, Inc., 1000 Main Avenue, Clifton, New Jersey, detailing the nature of the failure, and describing the manner in which the instrument has been used. The type and serial numbers of the equipment in question should be given. By return mail the Service Department will either send instructions for repairing the fault or authorize shipment of the instrument to the factory. By writing a letter before returning the instrument a considerable amount of time and effort may be spared. Frequently the Service Department is able, by mail, to diagnose the trouble and recommend means for correcting it, thus eliminating any need for returning the instrument.

3. If return shipment has been authorized, the equipment should be clearly identified by a tag bearing the owner's name and address. The equipment should be carefully packed and shipped in accordance with the instructions that will be sent by the Service Department.

4. If writing for a replacement component, always give the type and serial numbers of the instrument involved and refer to the component by its symbol designation and description as it appears on the circuit schematic shown in the instruction manual supplied with the instrument.

Damage in Transit

All Du Mont equipment is fully insured against damage incurred during shipment. For proper compensation for shipping damage, action should be taken immediately. A shipment should be given an immediate and thorough inspection on arrival. In cases where damage or shortage is noticeable on delivery, a notation, signed by the carrier, should be secured.

Equipment should be unpacked promptly. If concealed damage or shortage is found the carrier should be notified at once and inspection of the shipment together with a signed report of inspection should be requested. After the damage has been reported to the carrier Du Mont

(*Continued on Page* 16)

CASE HISTORIES • • •

The Oscillograph in action

The following two articles are the first of a series devoted to the applications of the cathode-ray oscillograph. In selecting these Case Histories from the files of the Applications Engineering Section of the Instrument Division, an attempt is made to choose those examples that best illustrate the great versatility of the cathode-ray oscillograph, and at the same time are most representative of the manner in which the oscillograph is solving problems of production, engineering and research in virtually every phase of modern industry and science.

The Problem

A manufacturer of aluminum castings for automotive pistons required a means for detecting porosity, inclusions, cracks, or other defects in the castings. Porosity results in excessive seepage of oil into the combustion chamber, causing fouling of the spark plugs, knocking, loss of power, and excessive oil consumption. Cracks and similar defects may cause scoring of the cylinder walls, necessitating reboring. The existing system of visual inspection was considered inadequate, since many of the flaws lay invisible beneath the surface of the casting.

The Solution

Du Mont engineers recommended the arrangement diagramed in Figure 1. A Du Mont Type 275-A Polar-coordinate Indicator was employed. The casting under inspection was mounted on a shaft and rotated at high speed. The two-phase generator of the Type 275-A was coupled to this same shaft so that a constant angular relationship was maintained between the rotating casting and the circular trace. A small quantity of radioactive material was fixed at the center of the piston and a Geiger-Mueller counter was arranged near the casting behind collimating slits. The counter and collimating slits were mechanically linked to the vertical-positioning control so that as the counter was moved up and down past the rotating surface, the circular trace moved correspondingly on the screen. As the counter was so moved, a "cylindrical" pattern was obtained. By means of this arrangement, and by proper setting of the eccentricity control of the Type 275-A, a reasonably accurate duplicate of the shape of the casting was obtained.

The output of the Geiger-Mueller counter, differentiated, was applied to the radial amplifier of the Type 275-A. Any defects in the casting altered the "transparency" of the casting to the radiation, and appeared as a roughness of the pattern at a point on the pattern corresponding to the actual location of the fault in the casting.

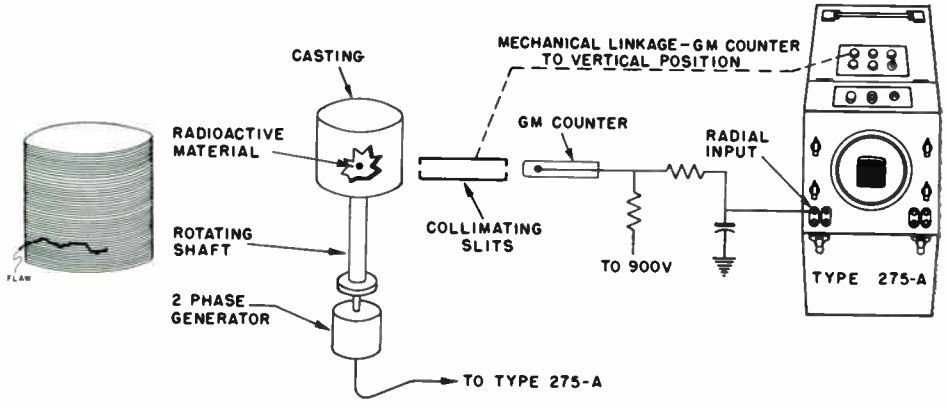

Figure 1. Set-up employed for the inspection of castings. At left is a sketch of the oscillogram obtained.

The Problem

A manufacturer of air pistols required a means for determining the muzzle velocity of his product as part of a production-test procedure. Since the pistol fired a .177-calibre lead pellet, conventional equipment for such tests, designed for projectiles of larger calibre, and operating by use of magnetic pick-ups, were not applicable. Other commercially available test equipments either were too costly, or did not lend themselves to production-test procedures. Seeking an economical, accurate means for determining muzzle velocity, that was capable of operation by unskilled workers, the company called upon the Instrument Division of Allen B. Du Mont Laboratories, Inc.

The Solution

An arrangement was devised employing 3 photocells and a Du Mont Type 304-H Cathode-ray Oscillograph. (See Figure 2). Each photocell was located opposite a source of a narrow beam of light. The air pistol was cradled in a rack, aimed so that the trajectory of the pellet lay between the light sources and the photocells. When the pellet interrupted the first beam of light, the low-speed, driven sweep of the Type 304-H was initiated. As the pellet interrupted the second and third beams, the electrical impulses generated thereby were applied to the vertical axis of the oscillograph, and were displayed on the screen as vertical deflections. From the distance between these deflections the muzzle velocity of the pellet could be readily computed.

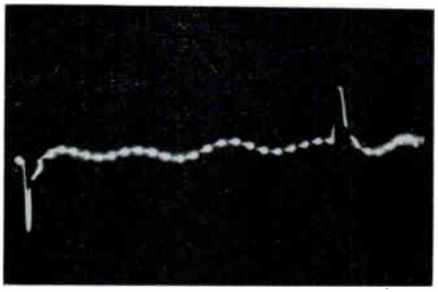

Figure 3. Oscillogram obtained from the set-up shown below. Polarity of one photocell was reverse in this case to avoid possibility of confusion between the two pulses.

The Type 304-H was equipped with a P7 screen and an amber filter. The high accelerating potential of the Type 304-H provided sufficient persistence that visual observation and measurement could be made with ease. Moreover, by marking on the screen the limits that represented maximum and minimum tolerable muzzle velocities, the test could be made readily by wholly unskilled workers.

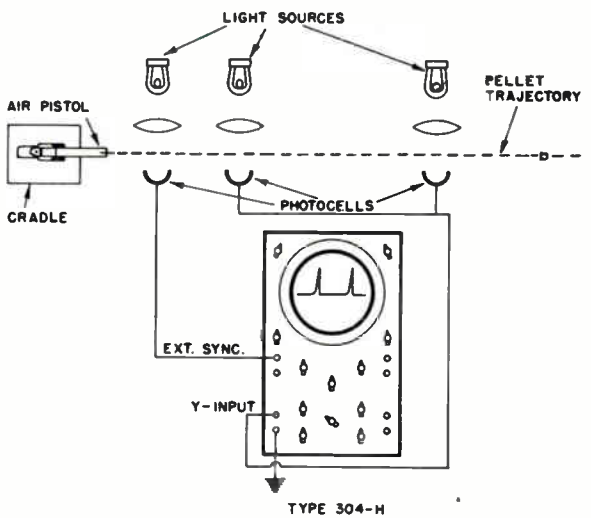

Figure 2. Schematic diagram of the arrangement for measuring the muzzle velocity of air pistols. This test proved accurate, and could be operated readily by unskilled workers.

INSTRUMENT SERVICE

(*Continued from Page* 13)

Laboratories should be provided with the information requested on the Damage Report that is enclosed with every shipment. Forward this Damage Report together with a copy of your report to the common carrier to Du Mont for appropriate action. Claims for damage or missing parts cannot be made without these supporting papers and claims must be made within 10 days from receipt of shipment. However, the sooner damage is reported, the easier are the problems of securing proper compensation. Common carriers are reluctant to make adjustments for damaged merchandise or to admit that damage occurred during transit unless the damage is reported promptly after arrival. The insurance does not cover any damage occurring after delivery and a delay in discovering concealed damage necessarily raises a question as to the time when the damage occurred.

Regardless of the condition of the merchandise, it is requested that the customer accept shipment and write the factory before making return shipment.

It is the purpose of the Service Department to assure the customer the performance for which his instrument was designed. The excellent facilities and highly trained personnel of the department stand ready at all times to deliver prompt, efficient and economical service to purchasers of Du Mont instruments.

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