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Ultrasonics and Electrical Devices Manufactured by

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Pt II 1

FLUOPHON II

Ultrasonic flow device for accelerating chemical maturing processes in liquid substances being treated with ultrasonics:

Ultrasonics output: 300 to 400 watts

Rate of flow of liquid: 30 to 200 liters per hour

The flow vessel is dimensioned depending on the viscosity and the sound absorption of the substance being treated, while the ultrasonics oscillator and the HF generator always are of the same dimensions.

All elements of the flow vessel, such as stopcocks, screw threads, piping, etc. are ASTRA standard parts as used in the dairy industry.

Fluophon II for constant treating of alcoholic beverages:

Prices: High-frequency generator with ultrasonics oscillator and 4-liter test vessel on tripod .....DM 4900.—

Flow device with flow meter, stppcocks, storage vessel, designed as echo vessel .....DM 2200.—

Shipment will be made about 2 to 3 months after order has been received. We reserve the right to pass on increases in the cost of materials to the consumer.

The Fluophon serves for accelerating chemical processes and for maturing and aging processes. The liquid to be aged is filled into storage vessel 1. This vessel is pumped full again, if necessary. The liquid flows through the regulating cock 2 into a special echo vessel which has a quadratic cross section and which is located inside the protective tube 3. When the liquid has reached the lower end of this vessel, at which point the ultrasonics oscillator 4 is also located, it leaves on the side through tube 5. A faucet 6 on tube 5 permits taking of samples. The liquid then rises, and passes through the flow meter 7 and the air valve 8 to the outlet 9. The entire flow device rests on tripod 10. The ultrasonics oscillator is connected to high-frequency generator 11 with a shielded cable. If only small samples are to be treated with ultrasonics, the ultrasonics oscillator can be removed from the vessel by loosening 3 wing nuts. The oscillator is then attached to the bottom of sample vessel 12 which has its own tripod. The device is then ready for

laboratory use. The high-frequency generator with the ultrasonics oscillator and the small vessel can also be supplied as a separate unit.

The entire apparatus is very easy to operate. The effect of ultrasonics on aging is dependent only on two factors: 1) on the time which each portion of the liquid spends in the sound chamber, i.e. in the flow vessel, 2) on the intensity of the sound. The first of these two factors can be controlled by turning the main regulating cock 2, while the second factor is not controlled [during operation]. After opening the door on the side, the intensity can be fixed at a ratio 1:2:4. Normally, setting 4 is used. To avoid any errors in operation, only the main switch has to be actuated after the door has been closed; no other setting is needed.

The principle of ultrasonics treatment with constant flow has one great advantage over treatment in closed vessels: In the former case, every particle of the liquid runs in the same succession through the ultrasonic field which becomes stronger from top to bottom; thus the product leaving the vessel must be homogenous. However, in ultrasonics treatment in closed vessels, individual particles will be more strongly affected by the ultrasonic waves, because they happen to be in the vicinity of the source of the waves, while others, further distant from the oscillator, will be exposed only to a slight effect. Thus the final product will always be nonhomogenous. In ultrasonics treatment of a continously flowing liquid it is important that the sound waves do not enter the vessel laterally due to temperature discontinuities in the liquid and thus be dissipated. For that reason, the vessel is made of special tin-plated sheet iron which is only 0.2 mm thick. The wall will afford full reflection of any incident sound wave, because of its thinness. There are thus no losses in the wall of the vessel. The quadratic cross section also has the advantage that the waves are reflected without any concave-mirror focusing effect, so that there will be a more or less homogenous sound field all through the vessel.

The fluophon and the vessel can be dismantled by loosening a few tin-plated ring nuts. It is built according to the principles used in the dairy industry, and uses many of the standard parts which have proved their worth in that industry, such as the main regulating cock, the storage vessel, all tubing, connecting studs, and stopcocks. It is thus a genuine

piece of industrial equipment.

Alcoholic beverages and perfumes containing no essences but natural concentrates which are responsible for the taste or aroma of the product are particularly suitable for artificial aging. All blended beverages, such as blended rum or brandy, are excellently suited for this treatment. Treatment of white wine in this manner is not recommended. On the other hand, it can be used successfully for ordinary red wine~~xxxxxxxx~~ mixtures made from wines of all different origins. The resulting aging effect is stronger immediately after treatment than any natural aging effect, due to the additional catalytic action of the ultrasonic waves. After storage of 8 days, the product will have reached its final maturity. On the average, the aging effected by the ultrasonics treatment corresponds to about two years of storing. With alcoholic beverages of normal quality, the Fluophon can process 50 to 150 liters per hour.

LARGE STROBOSCOPE

The large stroboscope generates controlled or periodic flashes of maximum instantaneous brightness and minimum duration.

A detachable spark chamber, filled with ~~technical~~ commercial argon and using sturdy tungsten electrodes, serves as light source. The extremely short flash of less than 1 μsec is achieved by transmitting the condenser charge to the spark gap by means of short connecting ribbons with an inductance below 10^{-7} Henry instead of using the customary cable. The peak current intensity is 10 ka, and the peak power in the spark ($t = 0.2 \cdot 10^{-6}$ sec) is 40 mw. This power is made possible by matching the electric spark resistance of an average of about 0.2 ohm to the aperiodic limiting resistance of the discharge circuit. Thus the time for converting charging energy into radiation energy is kept at a minimum.

By means of the painstaking development of the control device with use of very steep voltage surges for the ignition of the stroboscope lamp, the breakdown time fluctuation of individual sparks with reference to the control voltage will be about 10^{-7} seconds.

The quantity of light produced per spark is dependent on the flash frequency. An individual spark emits 150 lumen seconds.

The flashes can be triggered by the following means:

1. If periodic flashes between 300 and 20,000 per minute are required, a small stroboscope is used for control. The usual equipment includes a Drello stroboscope type Strob.105, but any other small stroboscope, for instance the Philips, General Radio [illegible] (USA), or R Rohde und Schwarz of Munich types, is suitable. The voltage pulses which otherwise would ignite the stroboscope lamp of the small stroboscope are now used to ionise a thyratron (BBC TQ 2/3) which in turn supplies a 200 kw ignition pulse to the ignition electrode of the flash lamp and triggers the flash with a minimum time fluctuation.

2. The triggering of the flash can be brought about by means of closing or breaking a contact. To utilize the accuracy of the stroboscope to the fullest, e.g. when observing the vibration of turbine buckets, the contact maker must connect with an accuracy of a few angle minutes with reference to the position of the drive shaft [illegible].

If no other type is available, the contact maker K 105 can be used for this purpose. This instrument makes contact with about 2' accuracy. If requested, an infinitely variable friction gear can be installed , which varies the flash up to ± 2% with reference to the position of the drive shaft. The contact maker carries only voltage and no current. It opens the thyratron by means of the voltage surge. When the contact is broken, the contact carries a load of 1 ma and 100 v.

3. Triggering a single flash: A single flash can be triggered by connecting the terminals of a photographic shutter to the stroboscope, or by a push button. The stroboscope can also be circuited in such a manner that, e.g. with use of a contact maker or a periodic control device, the subsequent making or breaking of the contact or the voltage pulse of the control device will trigger a single flash when a push button is pressed. The brightness of this single flash will suffice for making one well-exposed photograph (e.g. in a direct stroboscope beam at 3 m distance from the lamp with a lens aperture of 1:8, using 17/10 DIN film).

It is possible to work with flashes of greater or less brightness by changing the

gas pressure in the lamp, the way one can change the pressure in an automobile tire. At low pressure, e.g. 1 atm abs., the sparks are longer, the opening of the searchlight beam slightly greater than at high pressure which will bring about the shortest and brightest flashes. (The optimum matching conditions of the spark resistance are reached at about 4 atm gauge.)

The distance between the electrodes can be matched to the gas pressure by means of a knurled screw on the outside of the lamp. If the glass envelope becomes black or if the electrodes are burned out after long operation, the lamp is disassembled by removing three nuts, and cleaned. The electrodes are reground, or replaced, if necessary, and the lamp is then reassembled. The storage bottle for inert gas which is supplied with the device and which can be refilled with argon by any oxygen plant is used to refill the lamp with argon. Its conent will last for about 100 fillings. After two flushings with argon the lamp is filled to operating pressure again. This allows very economical operation.

The flash lamp is designed like a searchlight. It also contains the pulse condensers. It is cardanically mounted an a carriage of steel tubings, which can be taken apart, and can be turned in any direction. The lower plate of this carriage holds the high-voltage apparatus, the upper plate which is easily accessible carries the control device. A small table tripod can also be supplied. The lamp is connected to the high-voltage power pack by a high-voltage cable protected by a spiral hose. The special high-voltage plugs, when stripped, do not allow touching of any part carrying high voltage.

The stroboscope is shockproof and can be transported in an automobile. The construction kit principle has the advantage that in the many cases where only single flashes controlled by contact devices are required, there is no need to buy the control device. For specially intensive single flashes, e.g. for underwater pictures of ships' propellers, adding a larger condenser battery to the circuit will bring about the generation of flashes with ten times the light intensity per flash. In this case, the duration of the flash will be increased to $2 \cdot 10^{-6}$ sec. The additional condenser is not part of the standard equipment and must be ordered separately.

Weight of Stroboscope Lamp	15 kg
Weight of Power Pack	55 kg
Weight of Drello Control Device	15 kg
Weight of Steel Tubing Carriage	25 kg

	Single flashes	50 cps	100 cps	200 cps
Capacitance	0.2 µf	0.2 µf	0.08 µf	0.04 µf
Charging voltage	8 kv	5.5 kv	5 kv	5 kv
Energy per flash A= 1/2 CU^2	6.4 w	3 w	1 w	1/2 w
L Discharge Circuit	0.1 µh	0.1 µh	0.12 µh	0.15 µh
J max – $\sqrt{(CU)^2/L}$	$1.1 \cdot 10^4$ a	$7.5 \cdot 10^3$ a	$4 \cdot 10^3$ a	$2.6 \cdot 10^3$ a
N max el ~ J max U/t max ·0.5	$4.4 \cdot 10^7$ w	$2 \cdot 10^7$ w	$1 \cdot 10^7$ w	$6.5 \cdot 10^6$ w
Mean Rectangular Flash Duration A/N 1*)	$\sim 0.15 \cdot 10^{-6}$	$\sim 0.15 \cdot 10^{-6}$	$\sim 0.1 \cdot 10^{-6}$	$\sim 0.075 \cdot 10^{-6}$ sec
Mean Light Efficiency of Pulse Lamp, visually 25 Hlm/w, then max. Light Current	$\sim 10^9$ lm	$\sim 0.5 \cdot 10^9$ lm	$\sim 0.25 \cdot 10^9$	$\sim 0.15 \cdot 10^9$ lm
Light Quantity at the Lamp, lm·t	~150 lm sec	~ 75 lm sec	~ 25 lm sec	~11 lm sec
Maximum Light Density	$\sim 2 \cdot 10^7$ sb	$\sim 1.5 \cdot 10^7$ sb	$\sim 1 \cdot 10^7$ sb	$\sim 1 \cdot 10^7$ sb
Multiplied by Degree of Reflection of the Reflector and the Cutoff Efficiency ~0.3: Effective in the Beam per Flash: 2*	~ 45 lm sec	~20 lm sec	~7 lm sec	~3 lm sec
Peak light intensity in beam at 2 m distance	10^{10} cd	$7 \cdot 10^9$ cd	$5 \cdot 10^9$ cd	$5 \cdot 10^9$ cd
Flash duration from Ignition to Quenching to 1/e	0.6 µsec	0.6 µsec	0.4 µsec	0.3 µsec

1*) The bell-shaped curve of the flash, converted to a rectange of equal area, with the maximum output as height and the time as the base of the rectangle. For actual duration of the pulse, see last line of table.

2*) The beam leaves the reflector with a diameter of about 250 mm and spreads with increasing distance at a rate of about 1:4, i.e. at 10 m distance its diameter will be about 2.5m.

The apparatus consists of the following units:

1 High-voltage power pack for a range of 0 to 15000 flashes per minute for periodic pulses, for single pulses released by a photographic shutter or by a built-in push button, for outside control (periodic flashes) by means of a contact maker which connects or breaks a circuit through a built-in relay. Automatic locking device to keep unit operating in the method selected.

Tubes: 1 TQ 2/3 (BBC) (Price of replacement tube DM 130.-)
1 AG 1006 (AEG)
Line: 220 v AC, 250 VA. Price per unit: DM 2600.-

1 Line and connecting cable with special plug — Price per unit 25.-

1 Stroboscope lamp with special impregnated pulse condensers and dismountable discharge vessel, three selection ranges for full utilization of flash frequency range 0 to 15000 flashes per minute — Price per unit 1600.-

1 High-frequency cable with metal shielding hose and 2 plugs — Price per unit 95.-

1 filled inert-gas tank, with enough gas for 100 to 120 lamp fillings, complete with 2 manometers and reduction valve — Price per unit 150.-

1 Transport carriage with cardanically movable lamp holders — Price per unit 250.-

1 Control unit for generating periodic flashes of either 400 to 8000 or 700 to 15000 per minute (to be specified when placing order) with ultraflash lamp (xenon filling) with built-in scale, four selective ranges, connections for outside synchronizer, indication accuracy 0.5%, frequency constancy better than 2%.

Tubes: 2 AZ 11
2 EF 12
1 S 1/0.2 i II a
1 S 0.35/0.35
Line: 220 volts AC — Price per unit 1180.-

Our large stroboscope is the final result of the development started during the war on the generating of very intensive light flashes for stroboscopic measurements. In contrast to all other stroboscopes on the market, ours has the following unique characteristics:

1) The duration of the individual flashes, despite maximum brightness, is less than one-millionth of a second. This makes it possible to photograph and to observe motions which proceed very rapidly, e.g. those in which the object will change its location within a span of 0.00001 seconds. Such problems occur frequently in technology, e.g. in the necessity of obtaining photographs with high definition of threads on rapidly rotating spindles, measuring the droplet size during atomizing of fuel from nozzles, etc.

2) In our stroboscope, the flashes are controlled with such accuracy, that it is almost too small for measurement, being less than 10^{-7} sec. As a result, the observation of rapidly moving objects has very high definition, and the flash will strike the object always at the same spot, with an accuracy of a few angle minutes.

3) Photographs can be made with a single flash, the flash being triggered exactly at the correct phase of motion. This is accomplished by the constant control. To make photographing easier, the object can be slightly lighted prior to taking the picture with a stroboscopic hand lamp which will not expose the film sufficiently to produce a picture.

At the proper moment, a sinlge bright flash is triggered, which will suffice for a well-defined photograph with a small lens aperture.

4) Several large manufacturers have tried building large stroboscopes. All their instruments have lamps with a very short lifespan; replacements are very expensive and operations therefore are costly. Our large stroboscope employs a dismountable spark chamber which is filled with technical argon from a small flask, like an automobile tire. An automobile tire pressure gauge is used for checking. If the spark chamber has become blackened by spray from the electrodes, it need not be replaced. It is merely taken apart, cleaned with a rag, and Thus operation of the stroboscope is very inexpensive, and still cheaper than operation of a small stroboscope, e.g. one with a Neostron lamp, since even those lamps are costly.

5) By virtue of its design, the current consumption of the large stroboscope is so small, that it can be run on an automobile battery with a transformer. The type of transformers used in portable sound film units are adequate for the job. This, for the first time permits stroboscopic observation of phenomena in a moving vehicle, e.g. engine vibrations or tire wear.

Obviously, the above qualities cannot be achieved with cheap equipment. This explains the price of the device, which is, despite the closest margin, still way above that of small stroboscopes. It is therefore should appeal mainly to large manufacturing firms, where the precise research results attained with this device usually will make it pay for itself within a few weeks or months.

The Large Stroboscope in Technology

The stroboscope serves well wherever there are difficulties in technical development in rotations or vibrations which cannot be put into mathematical form during the drawing-board stage. It is impossible, for instance, to determine the vibrations of valve springs prior to operation, since the suddeness of the shock plays a role in addition to the initial tension of the spring. Stroboscopes can also be used for exact measuring of the slippage of V-belts and to determine the causes of the slippage. In complex gears, stroboscope, if necessary with the aid of a telescope, can be used to observe the meshing

of the gears. The large stroboscope is excellently suited for adjusting choppers, vibratory rectifiers, rotating rectifiers, and contact converters, as it permits, with normal lighting of the work site, carrying out the adjustment, perhaps even at several work sites simultaneously. It is also useful in the packing industry. In very slow processes which cannot be seen as a still picture by the eye, photographs with the lens kept open are used. Thus the phases of motion of the element being observed will be obtained superimposed in such a manner that the spread between the individual pictures on the same photographic plate will tell whether the apparatus is functioning properly. The stroboscope, in this case, emits single flashes at intervals geared to the low speed of the objects being observed, and catching the same element of the mechanism in its beam every time it comes around. A picture is made each time on the same photographic plate. (It permits observing the play of the bearing of a slowly running connecting rod.) In all such cases, synchronous control is used. The stroboscope is also useful in production control of sewing machines and zippers. In stroboscopic observation of a turbine bucket ring, the picture must be very sharply defined, if the machines is operating properly. If any parts, e.g. the buckets, vibrate, the picture will contain blurs. The extent of the blur is a direct measure of the amplitude of the vibration. The same applies to torsional vibrations of shafts. A gear or clutch without torsional vibration will show up in a stroboscope picture as sharply defined. If there are blurs or superimpositions, they can be used to determine the amplitude of the torsional vibrations. All investigations for avoiding fatigue fractures when material is being conserved, can only be carried out with the large stroboscope, as the flash periods of the stroboscopes known heretofore were too long to give sharp definition on the photograph, even in absence of any vibrations.

The task in determining the shape and size of droplets behind an atomizer nozzle by means of a stroboscope requires clear definition of the drpplets which often move as fast as 100 meters per second. The "Aladin" large stroboscope can solve even this task. It can thus be used for checking injection nozzles. In tire testing machines which test automobile tires under various loads and speeds, or in observing attire running on a good road, the

"Aladin" stroboscope can be used for observing the function of individual stretched points of of the exposure to heat can be observed , either by pbservation or by filming.

A large number of spindles on large textile machines can be investigated without changing the location of the stroboscope, as the parallel beam of light permits measuring the rpm of distant objects. It can also be used for observing the air flow in blowers, by adding tinsel to the air, perhaps of different colors, and taking photographs in rapid succession, unless precise interferometric pictures with the aid of the interference method are preferred. In that case, the single flashes of the stroboscope permit photographs of turbulent flow phases. The same applies to observing cavitation phenomena on ships' propellers. There is one special version of the stroboscope, with a waterproof lamp set up in the water in the immediate vicinity of the propeller, eliminating the loss of light incurred in the customary method of lighting from the outside.

Principally, the difference between a large stroboscope and the generally used normal small stroboscope, as far as light intensity is concerned, is about the same as that between a candle and a 100-watt bulb. The large stroboscope generates such bright flashes that each individual flash supplies enough light for a photograph even with a small aperture, so that it can be used as light source for high-frequency cinematography. In addition to that, the flash duration is only a microsecond (one-millionth of a second) while the smaller stroboscopes have flashes lasting 30 times that long. Objects which move fairly rapidly, such as the buckets of a small exhaust steam turbine, will appear blurred on the picture, if a small stroboscope is used for lighting.

The control device of the large stroboscope "Aladin" can be used separately as a small stroboscope, for purposes such as rpm measurements. It is therefore equipped with a large hand lamp and designed as a portable device.

The high-voltage control device of the large stroboscope charges a condenser battery and discharges it in less than one-millionth of a second. The stroboscope lamp converts 40,000 kw electric energy into light.

The difference in price between a normal glow stroboscope and the "Aladin" stroboscope is about 1:5, while the difference in light intensity is about 1 : 1000. Despite

the enormous increase in light intensity which, for the first time, makes the stroboscope suitable for exact scientific research projects, the device is very inexpensive to operate because it employs the principle of the dismountable lamp. If the stroboscope lamp becomes blackened, it is taken apart, cleaned, and refilled with gas. One filling costs about 0.03 DM. Due to the high efficiency of the lamp, its current consumption is very low, being about 300 w. The device can be operated from any electric outlet or, with a single-armature converter, from a portable automobile battery. It can therefore be used for investigation of a moving vehicle from the vehicle itself, as it is not sensitive to concussion.

ISOLEX HIGH-VOLTAGE INSULATION TESTER

System Dr. Fraengel-Langkau, German Pat. applied for, with continuously variable AC and DC voltage. Type I: 6 kv, Type II: 12 kv; Type III: 30 kv.

The "Isolex" can be used for the following purposes: AC and DC voltage testing according to VDE specifications, measuring of high-voltage insulation, troubleshooting for short-circuits and leaks.

Method of operation: The Isolex device permits voltage testing according to VDE specification, with AC high-voltage, as well as determining the insulation value with DC high voltage. Both can be carried out quickly and easily.

The control transformer at the left front side of the device permits infinite varying of the voltage which can be read off on a voltmeter. A special circuit makes it impossible to turn on the high voltage suddenly without first setting the voltage control back to zero. In addition to this, the high voltage will break down when certain amperages are exceeded. The device is thus to a very large degree accident-proof.

The insulation values are indicated not by a measuring instrument, but by a telltale lamp. The poorer the insulation, the quicker the sequency of light flashes. The light flashes are a measure of the quantity of electricity flowing (Coulomb counter). The lamp flashes every time 1 millisamp second has flowed through the test object.

The practical measuring range by means of the "leakage current" lamp comprises about 1 : 10,000 without switching. The "Defect" lamp lights up at once, if the insulation value is too low. The DC which can be obtained is smoothed, and amounts to a maximum of about 50 ma.

Additional equipment: Locating Defects by Power Pulses:

Insulation errors indicated by lighting-up of the "Defect" lamp, can be found easily with the device. For this purpose, a circuit is used which is operated by a push button and which transmits a short power pulse of several megawatts to the defective point in the object being tested. This pulse will generate a powerful, easily visible spark at that point; however, it is of such short duration that it will cause no damage. In many cases, it is even possible to repair minor defects in this manner by burning them out.

If cables are to be tested, the power pulses can be superimposed on the fundamental test voltage. If the fundamental voltage is, e.g., 5 kv, a 10 kv pulse can be superimposed, which will run into the cable as a traveling wave and is approximately matched to the traveling wave impedance of the cable. If this traveling wave causes sparkover, it will remain even after the traveling wave has subsided, due to the fundamental voltage, and will be detected as an insulation defect by the Coulomb counter with the "Leakage" indicator lamp.

Specifications of Isolex Insulation Tester

for insulation testing, with infinitely variable DC and AC voltage, with indication of defects in AC tests and indication of quality and defects by telltale lamp signal flashes in DC testing, with indicator for selected test voltage, and ammeter for checking quality of AC and DC voltage.

Voltage regulation by rotary transformer for 220 or 110 v AC line.. Current consumption 1 kva.

Two-unit construction. Control part in portable sheet-iron case, high-voltage part portable, with protruding high-voltage insulators for connecting test cable.

Prices: Type I..... 6 kv ..... DM 3,350.-
Type II....12 kv 4,250
Type III...30 kv 5.200.-

Additional equipment: For locating defects by power pulses. Selectable pulses, equal to the fundamental voltage, two, three, and four times the fundamental voltage. Pulse is superimposed onto fundamental test voltage, can be operated only with DC voltage tests by simultaneous operation of two push buttons. Pulse power above 5 mw. Internal resistance of pulse generator below 100 ohm.

Additional charges for type I.... 1400 DM
For Type II... 2400 DM

Shipment will be made within 1-2 months from receipt of order.

The manufacturer reserves the right to increase the prices because of increases in the price of materials between the date of this offer and the date of receipt of order.

A 15 per cent increase due to increases in prices of materials is in effect on all prices quoted above.