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THE SPEX 9010 ARC/SPARK STAND

by

D. O. LANDON and A. J. MITTELDORF

The arc/spark stand has come a long way since the spit-and-baling-wire days when spectrographers rigged up a pair of welding clamps to hold electrodes and peered at the shimmering arc with welding goggles. Those were the days when a spectrograph was used mainly in Physics I college courses, not in industrial laboratories; when electrodes were borrowed from moving picture projectors and photographic plates from astronomers; when hair dryers became plate dryers, motor-generators became dc arc sources, pencil sharpeners became electrode cutters; when grating spectrographs were all but abandoned as hopeless.

Those were also the days when spectrochemical analysis was little better than qualitative. As it became increasingly apparent that the spectrograph was capable of quantitative accuracy, constant advancements toward this end were made. In the arc/spark stand itself, means were provided for aligning the electrodes using first external then internal optics. Attachments were added for handling solutions and flat specimens, working in inert atmospheres, rotating the specimen and cooling the electrode clamps.

Here is where we began, wondering how the arc/spark stand could be further improved. Reasoning that most spectrographs become obsolete largely because the arc/spark stand is no longer up-to-date, we first decided that our instrument should be designed to fit on almost any spectrograph* in order to permit its upgrading at a fraction of the cost of a new one. This was accomplished by moving the controls to the top of the arc/spark stand, thus leaving room at the bottom for adjusting the height to conform to the optical requirements of the individual spectrograph. In the lower space there is often room for a spare-parts drawer* and the section also accommodates the proper adapter to fit the optical bar. Over this lower section, there is a sheet-metal skirt matching in appearance the housing of the 9010 Arc/Spark Stand itself.

For Bausch and Lomb instruments no skirt is necessary, the optical bar rider being mounted underneath the main housing. For ARL, Baird, Hilger, Jarrell-Ash and other spectrographs, a skirt of the right height is added to the 9010 and the appropriate clamp and rider are attached inside. Whether or not a drawer is added depends, of course, on the height. Thus the 9010 is adaptable to almost any existing spectrograph.

Inside, the walls and ceiling of the Arc/Spark Stand are constructed of white Formica* which is heat and acid resistant and can readily be washed down. With the exception of the jaws themselves and two motor shafts extending through from the side compartment, there is nothing protruding to catch fumes and cause contamination* from one sample to the next. Even the motor shafts are protected with polyethylene caps*. Although the interior is not gas tight, sheet rubber used as a seal between the main and rear compartments keeps fumes from seeping through to the rear. Most of the fumes are exhausted through a hole directly above the electrode clamps.

In the past, electrode clamps have been subject to much criticism and, accordingly, to a good deal of thought on our part. Chromium-plated brass, the most common material used, corrodes both from chemicals vaporized during excitation and from the heat generated. Our choice is rhodium*-plated brass with an undercoat of nickel. Finished to military specifications, the combination is one of the best both from the standpoint of corrosion and abrasion. To eliminate the effects of heat altogether, the jaws are internally cooled. They are constructed in such a fashion that there is a large reservoir* inside. Water circulating at a rate of a few gallons per minute keeps the jaws so cool that they may be touched immediately after burning a sample for a couple of minutes at 30 amperes. A flow gauge* and control* permit the operator to check and regulate the water flow and, in the event that it is not started immediately, the water in the reservoir absorbs the heat. In older designs with small tubes inside the jaws, overheating would sometimes cause the water to boil and burst the rubber connector.

As an optional accessory for the 9010, we can supply a centrifugal pump and 5-gallon polyethylene carboy for recirculating distilled water through the clamps. Using it the water pressure remains fixed and there is no loss of current through the distilled water. By contrast the use of tap water, especially in locations where the water has a high mineral content, is poor because of pressure variations, waste of water and possible leakage of current through the water. Large

*To emphasize those features not included in other commercial arc/spark stands, an asterisk is used throughout the article.

pressure variations can also cause a blow-out of the rubber tubing.

Mechanism

Dr. V. A. Fassel (1) and co-workers at Iowa State College, are responsible for the original design of the bilateral adjustment of the clamps as well as the open-box construction of the 9010. By bilateral adjustment is meant that both jaws of the clamp move together or apart as a unit, the center remaining fixed at all times. Regardless of what the diameter of the upper and lower electrodes is — and these can differ in diameter — they are automatically aligned one above the other using such clamps. In our design, the jaws are sufficiently rugged that they cannot be misaligned appreciably by hand force. Linkages and other parts, too, are constructed to offer trouble-free performance.

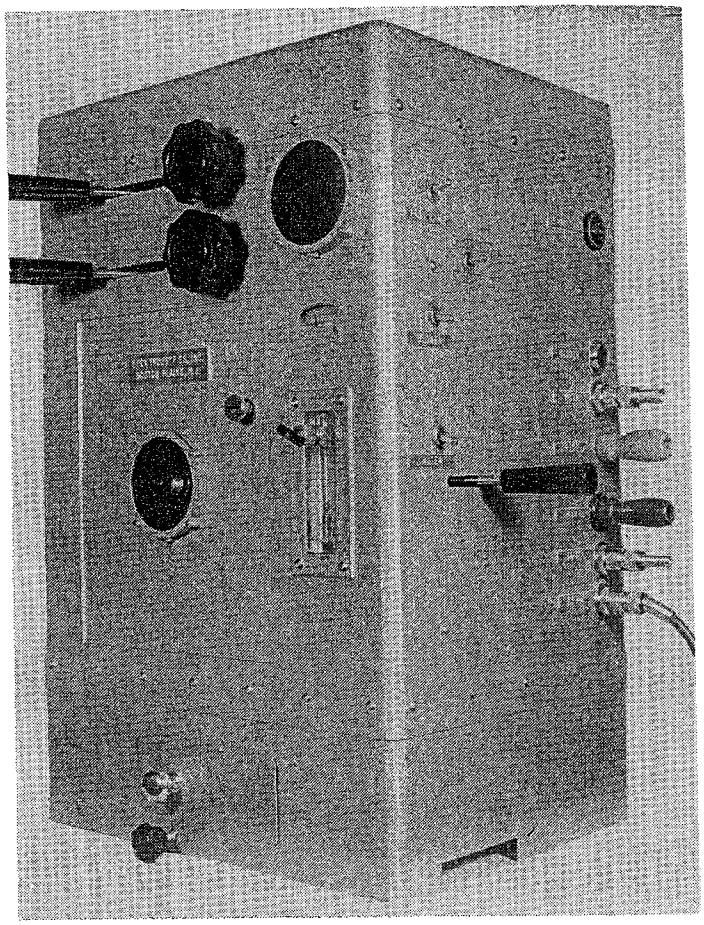
Another major improvement over older stands is the change from a rack-and-pinion drive for vertical adjustment to a long lead screw. The former wears in those spots where it is most frequently used and, after a time, slippage of the electrodes occurs. If this happens, a new rack must then be installed. The drive cannot be adjusted because wear is not even along its entire length. The use of a screw and nut prevents slippage altogether and wear is never a problem.

To position the electrodes before the burning, a projection system is employed in which the images of the electrodes appear on a ground glass screen at a magnification of 4X. The magnified image is erect: the upper and lower electrodes are viewed as they would be directly, rather than inverted. They are seen against a reticle calibrated in millimeters to permit rapid alignment both vertically and horizontally. Mounted over the ground glass screen is a variable density Polaroid filter which permits the operator to adjust the intensity of the image to the optimum value after the burning starts. Sometimes, however, the operator wishes to examine the electrodes themselves and not their image, particularly when he is setting up conditions for a new method. For this purpose, a second variable Polaroid screen is located on the door, in line with the center of the electrodes.

Operation of the jaw clamps is through controls thoughtfully worked out for convenience. To raise the upper electrode, for instance, the upper spinner knob is turned; the lower knob adjusts the lower electrode. Similarly, handles are located one above the other to open or close upper and lower jaws. Spent electrodes drop into a tray for later removal. Pushing the handles all the way locks the jaws open for ease in cleaning.

One annoyance with many arc stands is spattering of molten materials onto lenses and other optical surfaces, eventually pitting them so badly that they have to be replaced. To overcome this, we have placed covers of glass or Suprasil** quartz over the windows. The lens cell sandwiches the condensing lens in position and may readily be removed for cleaning. A filter mount is placed on the inside of a small door* which turns on the opposite side of the same hinge used for the main door. Not only is this door convenient for changing filters but it is also handy for cleaning or replacing the projection lamp itself.

The lamp, incidentally, is 50- or 75-watt prefocused, obtainable in most photographic stores. To prolong its life, a Thermistor* "shock-absorber" is placed in series with it, preventing power surges when the lamp is switched on. Normally, it is turned off automatically when the door is closed but a switch



Spex 9010 Arc/Spark Stand.

on the side panel controls the lamp independently. Incidentally, all switches are located on this side panel. Having one place for switches* is not only a convenience, it serves as a check-list for the operator before starting the exposure. A glance at the panel tells him whether water pump, air blower, motor and projection lamp are on or off. The panel also has an electrical outlet* into which other accessories may be plugged.

Safety Features

Exhausting fumes while a sample volatilizes in an arc is not the trival problem it would seem. The exhaust sweep of air must not be too great, otherwise a low current arc has a tendency to blow out. Furthermore, if the make-up air duct is not positioned properly, the arc will be blown to one side or the other creating instability. Our solution was mainly to supply both a draft gauge* to permit the spectrographer to measure the pressure at all times and a simple flap valve to control it. In addition, we have located the holes for intake air so that it enters in front of* and behind* the electrodes thus helping to sweep the arc upwards and in line with the optical path.

A more severe problem with fumes is when highly toxic materials are burned. To handle these, we have catalogued an accessory filter box* and pre-filter*. The latter is located inside the stack and may easily be taken out to replace the filter wad. This prolongs the life of the main filter, a so-called ultimate type capable of removing over 99.97% of all particles greater than 0.3 microns in diameter. When using a pre-filter and filter arrangement, the draft will, of course, steadily decrease. Using the gauge and control, however, it may be kept constant until it is necessary to replace the pre-filter.

**See Tricks of the Trade, this issue.

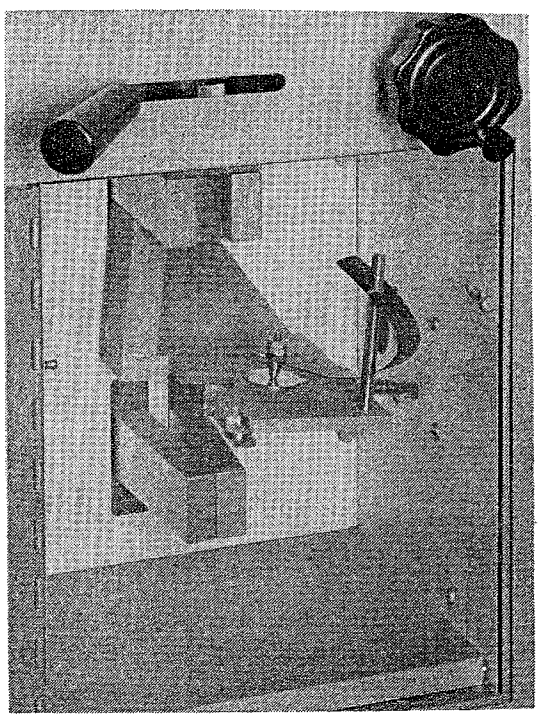
The exhaust system thus serves a double function: (1) to keep the draft constant and improve stability and thus reproducibility of the arc; (2) as a safety measure to keep toxic or radioactive fumes out of the room.

While on the subject of safety, it might be well to mention other such features of the 9010. An interlock switch is included normally permitting the source unit to operate when the door is closed. Occasionally, however, the spectrographer may want to operate the instrument with the door open, to analyze a long bar, for example. To do this, a special switch* is employed which may be "bugged" by pulling its actuator shaft out. What happens if he forgets to return the shaft to its normal position? The next time the door is closed it does this automatically. Another safety feature of the stand is a gap in parallel with the analytical gap. Its separation is about 6 mm and in normal operation will not short across. But suppose, the absent-minded operator forgets to put the electrodes in place and presses the start button on his source. Instead of sparks flying all over the place and, in all probability, doing damage, the safety electrodes spark across.

The Petrey Table

Invented about 20 years ago, the Petrey table is still used for the analysis of most solid specimens without much change in the original design. In operation, the lower electrode is pushed down with a spacer and the sample is placed on top of the table. In view of the simplicity of the original stand, we found room for some helpful additions. An inspection mirror* was added to facilitate alignment of the sample. Often a porous casting or an irregular piece must be analyzed and a mirror is a neat alignment aid. Another feature of our Petrey stand is a turntable* which may be snapped in or out of position as desired. As has been shown by Hurwitz (2) and Clark (3), precision values for a sample which is moved slowly while being sparked are often improved considerably, especially if the sample is segregated.

The Spex Petrey Table is positioned by slipping it into the upper electrode jaws of the 9010. So constructed that it is supported both by the arc stand jaws and the rear wall, it is very sturdy and can, in fact, easily support 20 pounds*. The vertical motion of the electrode jaws is accomplished through a nut and lead screw, as has already been mentioned, so that heavy weights cannot cause the table to drop. When the sample is to be rotated, a small piece of rubber tubing is connected between the motor shaft and the nylon turntable shaft. The recommended speed of rotation is about 1/3 rpm corresponding to a motor shaft speed of 2 rpm.



9011 Petrey Stand showing turntable and hold-down spring.

In addition to reducing segregation errors, the turntable is useful for the analysis of foils and other thin specimens. Here it is advisable to place a copper or aluminum block on top of the specimen and hold both down with the special leaf spring provided on the stand. In this fashion, the spark will not heat the sample excessively nor have a tendency to pierce it. Working curves for thin specimens should match those produced with thicker specimens using this technique.

Still another feature of the Petrey Table is a tube* permitting the sample to be sprayed with a gas while the sample is sparked, as suggested by D. L. Fry (4) and co-workers. The flexible tube is screwed on to a feed-through connector and gas is admitted from outside the chamber.

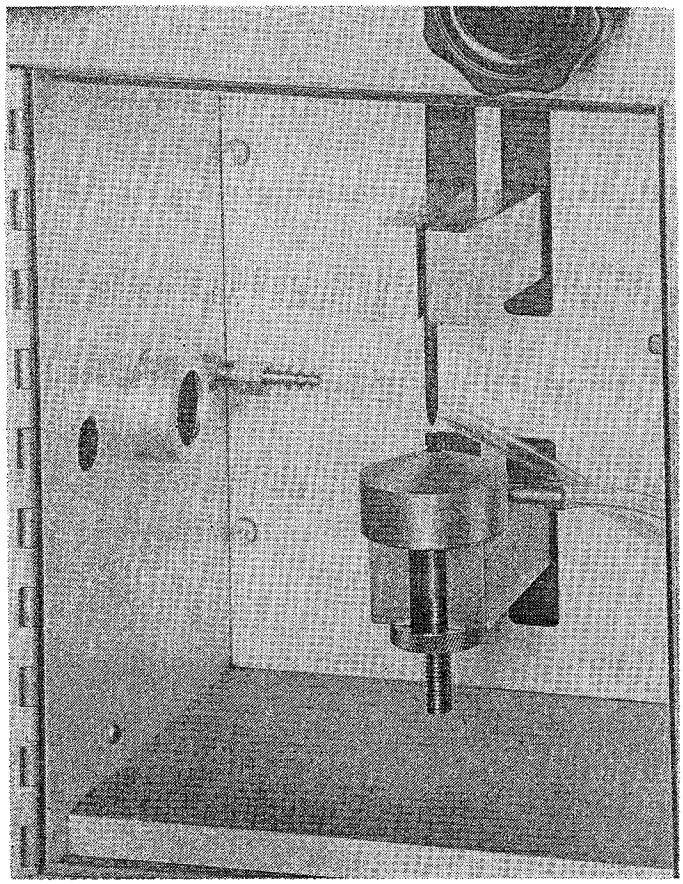
Enclosed Arc Chamber and Stallwood Jet

The extensive work of Thiers and Vallee (5) pointed up the possibilities of improving the sensitivity of many elements through the use of an enclosed chamber flushed with gasses other than air. The concurrent work of Stallwood (6) showed how improvement in stability of working curves and reduction of matrix effects could be achieved by blowing a strong curtain of gas upwards around the sample as it is burned. Logically, Shaw, Wickermasinghe and Yip suggested the combination in order to double the advantages. And going another step forward, our contribution is an accessory* designed to be almost as convenient to use as the conventional open arc.

Stallwood reported striking improvement in overall precision. In experiments with five powders of widely different composition, working curves for 30 elements were such that, without prior knowledge of the matrix, the spectrographer could determine all elements within a factor of two. The Stallwood thus achieves semi-quantitative accuracy without diluting the sample, permitting the determination of trace elements that would otherwise be lost. As for improved arc stability, this is easily demonstrated by burning a sample of potassium or lithium carbonate in a Stallwood before and after turning on the jet. Immediately, the arc, which had been hopping all along the length of the upper electrode and wandering erratically around the lower, seems to stand upright.

At the last Pittsburgh Conference, Joensuu (6) demonstrated that the analysis of rare earths was benfited considerably using the Stallwood jet. He confirmed all of the inventor's claims but chose carbon dioxide rather than air in order to eliminate most of the CN bands.

The Spex Stallwood Jet* is an accessory in itself and can be used with almost any arc stand provided the lower electrode jaws open to at least 1/2″ and the space inside will accommodate a 2″ d. x 3/4″ high cylinder. The accessory is rhodium plated to permit arcing corrosive solutions as well as solids. To the main section of the jet is attached a threaded tube in which the electrode is placed (one end of the tube is for 3/16″ electrodes, the other for 1/4″). The tube, in turn, is adjusted vertically inside a sleeve and the latter is clamped in the lower jaws of the arc stand. The design permits the spectrographer to adjust the jet for any preform. That is, electrodes with



9014 Stallwood Jet mounted in bi-lateral clamps. Note attachment to gas inlet which may also be used to spray a stream of gas on the underside of a sample held in the Petrey Stand.

shallow cups are held lower than those with deep cups. The gas is admitted at a rate of 3-5 liters per minute through a cap which slips over the top of the Jet and is constrained to swirl annularly before being driven upwards around the electrode.

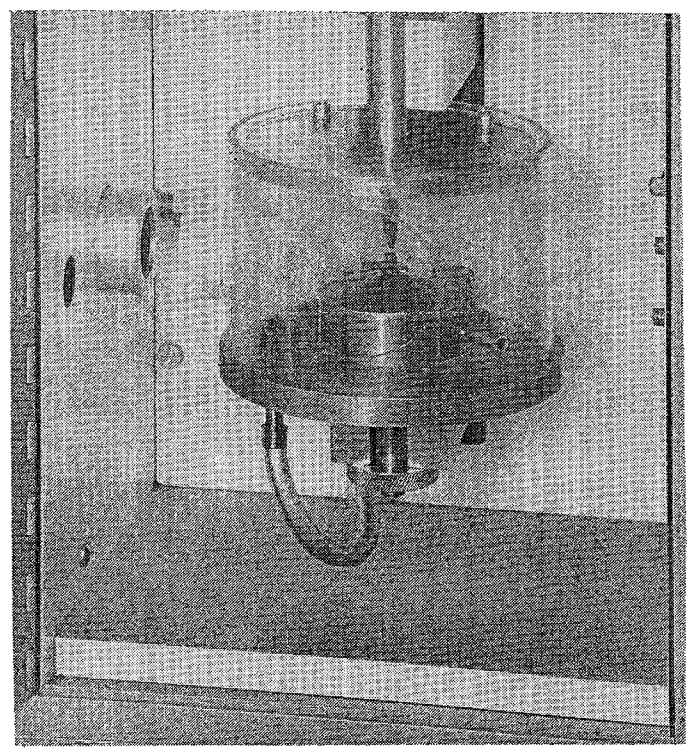
Although it may be used as a separate attachment, the Spex Stallwood Jet is designed to fit inside the Spex Arc Chamber*. Either can be used alone or both in combination. The Arc Chamber, which will fit most arc stands, consists of two closely fitting telescoping cylinders of transparent Plexiglas, the outer one having an o.d. of 4-1/2". These are connected by means of end plates to 1/2" d. stems which, in turn, mount inside the upper and lower clamps of the arc stand. The entire assembly merely snaps into place and is then locked by means of a large nut to both jaws. With this arrangement, the upper electrode control adjusts the inner cylinder; the lower electrode control adjusts the outer cylinder. This permits the electrodes to be pre-aligned using the standard optics of the Arc/Spark Stand, the projection lamp shining through the transparent Plexiglas. It also permits the electrodes to be adjusted during the burning while being viewed in the same way. The lateral adjustment as well, can be made both before and during the burning.

The telescoping arrangement, in addition to permitting up-and-down alignment, offers a very rapid method of loading and unloading electrodes by rotating one cylinder inside the other. The inner cylinder turns through 90° so that a hole in it, through which the arc light normally passes, lines up with a hole in the outer cylinder, allowing the spectrographer to reach in to change the electrodes. Turning the inner cylinder back to the operating position automatically seals the chamber. A gentle reminder to the spectrographer to make sure the cylinder is in operating position is the handle on the cylinder which extends out preventing the main door of the 9010 from closing when the access windows are open. A slight positive pressure of gas is all that is required to bathe the electrodes in the chosen atmosphere.

Shaw and co-workers (7) showed how, by eliminating cyanogen bands almost completely, the enclosed Stallwood jet is capable of providing greatly increased sensitivity for Ga 4172A and Pb 3683A. They also reported a generally reduced overall background using argon and argon-oxygen combinations. The precision reported, a direct result of the stabilizing influence of the jet, is really remarkable for a dc arc method.

Conclusions

The 9010 Arc/Spark Stand was designed to nudge the frontiers of spectrochemical analysis a little in the direction of better accuracy, speed and convenience. Final evaluations await field tests in research and production laboratories.



9015 Enclosed Arc Chamber with the 9014 Stallwood Jet in place. These accessories may be used alone or in combination.

References

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5. Thiers, R. E., Vallee, B. C., *Spectro. Acta, 11,* 179, 1957.
6. Stallwood, B. J., *J.O.S.A., 44* 171, 1954.
7. Shaw, D. M., Wickermasinghe, O., Yip, C., *Spectro. Acta., 13,* 197, 1958.
8. Joensuu, O., Pgh. Conf. March, 1959 (unpublished).

ARC/SPARK STAND PRICE LIST

9010 Arc/Spark Stand. Custom made to fit user's optical bar (specify type of bar and also the vertical distance from top of bar to center of optical path). Includes projection system with 2 variable Polaroid filters for viewing electrodes directly; flow meter for checking water cooling of electrodes; draft gauge for monitoring exhaust system; safety switch; connection for inert gas; lens holder; filter holder, switches and outlets for exhaust blower and water circulating pump; tray for removing spent electrodes **$1,250.00**

9010A Skirt to fit user's spectrograph (not required on B & L spectrographs or others in which the distance from the top of the optical bar to the center of the optical path is less than 6"). Finished to match the 9010; drawer for storage of tweezers, electrodes, brushes, etc. Specify type of spectrograph and bar to optical path height ..... **$ 20.00** 30.00

9011 Petrey Stand. Mounts in upper jaw of 9010; complete with 2, 3 or 4 mm spacer (specify); mirror for inspecting sample alignment; hold-down spring for samples; turntable for rotating samples in order to reduce segregation, and 2 rpm motor **$145.00**

9013 Blower-filter Assembly, includes 6-foot length of 3" i.d. Flexhaust, pre-filter with supply of glass wool; filter box designed to remove 99.97% of all dust particles 0.3 micron in size or greater; blower 75 cfm free air **$140.00**

†9014 Stallwood Jet, for stabilizing arc by surrounding it with a blanket of air or other gas. Designed to be used either separately or inside the Enclosed Arc Chamber 9015. Overall diameter 2"; o.d. of stem which fits in lower electrode clamp 1/2"; constructed of rhodium-plated brass; interchangeable for 3/16" (0.180") d. or 1/4" (0.242") d. electrodes ..... **~~$50.00~~** 60.00

†9015 Enclosed Arc Chamber, for bathing sample in special atmospheres, especially those free of nitrogen to remove cyanogen bands. May be used alone or with 9014 Stallwood Jet. Designed for ease in loading and aligning electrodes with transparent, rotating and telescoping Plexiglas housing; Suprasil quartz window transmits below 1700A; stems which fit in electrode clamps are 1/2" d.; overall diameter of Chamber 4-1/2" **$198.00**

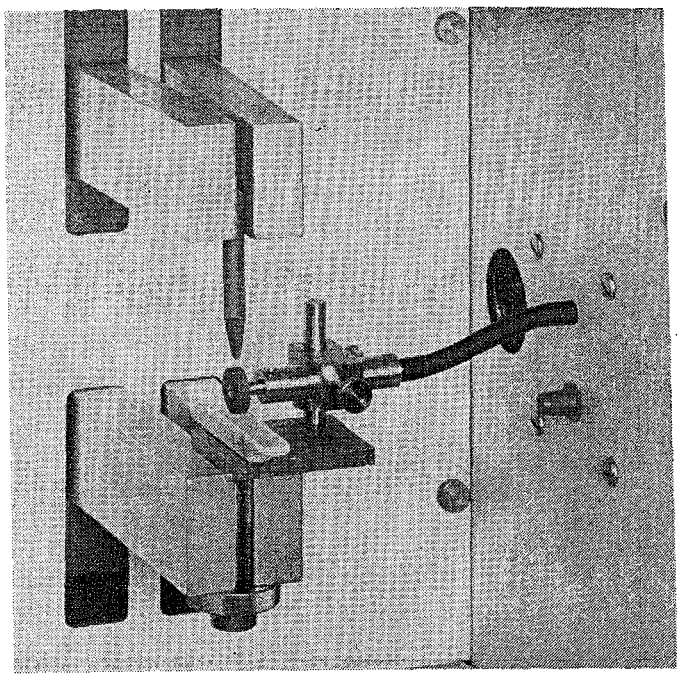
9016 Lucite Shield, used to protect 9010 from spattering of corrosive solutions when they are sparked; cylinder 5" d. to fit around electrode clamps of 9010 ..... **$ 15.00**

9017 Replacement lamp for projection system .... **$ ~~1.60~~** 2.00

†3200 Circulating Pump Assembly, includes pump, 5-gal. polyethylene carboy, 20 feet of rubber tubing, 115 vac **$110.00**

†3300 Petrey Stand Sample Clamp. Used for gripping small and/or irregular objects on Petrey Stand. Constructed of chromium-plated brass. **$ 32.00**

†These accessories may be used with almost any arc/spark stand, not necessarily the Spex 9010. Before ordering check dimensions to be sure they will fit your instrument.



3400 Combination Analyzer set up for rotating electrode technique. It may also be mounted vertically with a platrode adapter for analyzing dried or charred materials.

†3400 Combination Analyzer, for the analysis of solutions. May be used with shaft vertical for platrode technique or horizontally where a disc electrode dips into the solution contained in a boat **$195.00**

†3402 Table adapter, for 1/4" or 1" d. discs ..... **$ 12.00**

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NEW MIXER/MILL GRINDING VIALS

The 8001 hardened tool steel and the 8004 tungsten carbide grinding vials have been completely redesigned with screw-on plugs at either end. The change facilitates loading and unloading, also simplifies the handling and grinding of liquid slurries. Corprene (cork bonded with Neoprene), the gasketing material, is impervious to water and swells only a trifle using an organic solvent such as tetrachloroethane (Perchlor in dry cleaning parlance).

A second major change in the tungsten carbide grinding vial is an increase in capacity from 20 to 60 ml, accomplished by force-fitting the WC into an aluminum shell to combine the advantages of the hardness of WC with the lightness of aluminum.

8004 Tungsten Carbide grinding vial, capacity 60 ml, grinding capacity 20 ml. With two tungsten carbide ball-pestles ..... **Each $125.00**

8001 Grinding Vial. Case hardened steel body with screw-on ends of hardened tool steel, capacity 65 ml, grinding capacity about 25 ml. With four 1/4" dia. and two 1/2" dia. hardened steel balls ..... **Each $ 40.00**

8000 Mixer/Mill, Grinder and mixer. 1/3 HP Motor, 115 vac. (Net weight 64 pounds, crated 85 pounds.) ..... **Each $296.00**

ILFORD X-RAY FILM

Diffractionists and crystallographers will be interested in Ilford Industrial G, X-ray film now available in the United States. It has higher contrast and considerably less background than American types while retaining the same fine grain and definition. Recently, Paul Lublin and Vincent Brophy of the Sylvania Research Laboratories in Bayside, Long Island, tested the film in two different laboratories. As a result of tests in which they found several weak lines, lost in the background on other film, they have decided to switch to Ilford film. The only possible disadvantage they found was a somewhat slower speed, necessitating about 20% longer exposures. Processing conditions were kept the same.

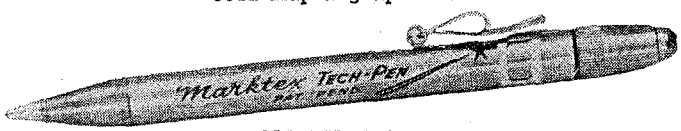
Please pass this information on to your x-ray diffractionists who may not be on our mailing lists. We are stocking three sizes of the Ilford film at present and, if the demand warrants, other sizes will be added.

Ilford Industrial G, X-ray Film, 35mm x 25 feet, for Philips and RCA X-ray diffraction units.
Per roll ..... Discontinued ... **$3.50**

Ilford Industrial G, X-ray Film, 48mm x 25 feet, for GE X-ray diffraction units.
Per roll ..... Discontinued **$5.00**

Ilford Industrial G, X-ray Film, 5" x 7" Discontinued
Per box of 75 sheets **$13.00**

3912 Rapidograph Pen



3910K Tech-Pen

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BELATED TRICK OF THE TRADE

Maintenance of Sauter Ultramatic Balance

In order to prevent the beam from sticking and the balance point from overshooting, remove the back cover of the balance and, using a lint-free cloth dipped in alcohol, wipe the contact surfaces of the beam and arrestments. The latter are cylindrical in shape and move upwards against the beam as the locking knob on the front of the instrument is turned.

FORMULA LISTS INDEXING DMS SPECTRAL CARDS

A formula list indexing the first two volumes (approximately 3200 spectral cards) is now available. The formula list is in the form of an attractive 52-page publication. Under each molecular formula are given the English names of the compound as they appear on the cards and the corresponding DMS serial numbers. The elements are given in Hill's order based on a simple principle explained in the publication.

For the current volume No. 3, a supplementary formula list is being published for each of the four issues. These supplementary lists are cumulative and, at the end of 1959, a complete one covering all three volumes will be sent.

DMS Formula list, cumulative Vol. I, II and III..... $8.50

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RAPIDOGRAPH PEN

At long last we have found a fountain pen suitable for marking spectrographic plates and are hastening to make it available. It is the Rapidograph fitted with a No. 00, extra-extra fine point. The pen is the only nonclogging technical fountain pen which uses regular writing or India drawing ink. Its outstanding feature is an assured constant fine line width, enabling the spectrographer to letter and mark plates neatly and accurately. Although it is possible to write on the emulsion of the photographic plate or film, it is preferable to use the clear side.

Please do not confuse this with the Tech-Pen which we recommend for general laboratory marking. Employing a ballpoint and a lacquer ink, the Tech-Pen writes on any surface (the lines are quite broad, however) and the ink resists high temperatures as well as acids.

3912 Rapidograph fountain pen, for marking plates and uses where extremely fine, uniform lines are required ..... **Each $4.50**

3913 Rapido-Eze pen cleaner, 2-1/2 oz. jar..... **.80**

3910K Tech-Pen, including tube of ink. Specify color: red, green, black, yellow, orange, white or blue ..... **Each 4.50**

3911K Refills for Tech-Pen, Specify color as above. **Each** ..... **.75**

MEETING NOTICES

Boston College intensive course in Modern Industrial Spectrography, at Chestnut Hill, Boston, Mass., from July 20 to July 31, 1959. Additional information may be obtained from Prof. J. J. Devlin, S. J., Physics Dept., Boston College, Chestnut Hill, Boston 67, Mass.

Rocky Mountain Spectroscopy Conference, Denver, Colorado, August 10-11, 1959. For further information contact the Program Committee, 718 Sherman St., Denver 3, Colo.

8th Annual D.I.R. Metallurgy Division X-ray Conference, Estes Park, Colorado, August 12-15, 1959. Contact Mr. M. Salmon, 718 Sherman St., Denver 3, Colorado, for details.

Fisk University Infrared Spectroscopy Institute, Nashville 8, Tennessee, August 24-29, 1959. Mr. J. R. Lawson is Co-Director of the Institute.

6th Ottawa Symposium on Applied Spectroscopy, Ottawa, Canada, September 14-16, 1959. Obtain further information from Mr. W. O. Taylor, Ontario Dept. of Mines, Parliament Bldg., Toronto, Ontario.

Eastern Analytical Symposium, Hotel New Yorker, New York City, November 4-6, 1959. This meeting will be jointly sponsored by the following groups:

New York Section, S.A.S.
Delaware Valley Section, S.A.S.
New England Section, S.A.S.
Baltimore-Washington Section, S.A.S.
Analytical Group, New York Section, A.C.S.
Analytical Group, North Jersey Section, A.C.S.
Metropolitan Michrochemical Society

For information contact Dr. Mabel F. Wilson, Air Reduction Corp., Murray Hill, N. J.

tricks of the trade

MAKING MANY MIXES

R. F. Plunkett, of the Test Department of the Southern Railway in Alexandria, Va., is using a Mixer/Mill for simultaneously mixing eight samples of Diesel oil ashes with a buffer prior to analyzing them. The samples, in 1/2″ d. x 2″ long plastic vials (Spex 3116), are, in turn, placed inside a plastic jar (8002) and shaken for a period of 1 minute. The Mixer/Mill has thus replaced two or three Wig-L-Bugs which had been in almost constant use.

PACKING CENTER-POST ELECTRODES

Of all electrodes, center-post types are hardest to pack. Generally the center post protrudes above the surface of the crater forcing the technician to pack the electrode around it—a time-consuming operation. Several center-post designs are fairly commonly used for the analysis of used oils by the ashing technique, for the analysis of zinc oxide, etc., the center-post serving to improve the stability of the arc. The Elpac, a new instrument manufactured in the Union of South Africa and distributed by Spex Industries, permits packing of center-post electrodes in a fraction of the time required with hand packing. Dr. Strasheim, inventor of the Elpac, has shown that the instrument can be used to pack center-post electrodes with the same ease as ordinary cavity ones.

QUARTZ

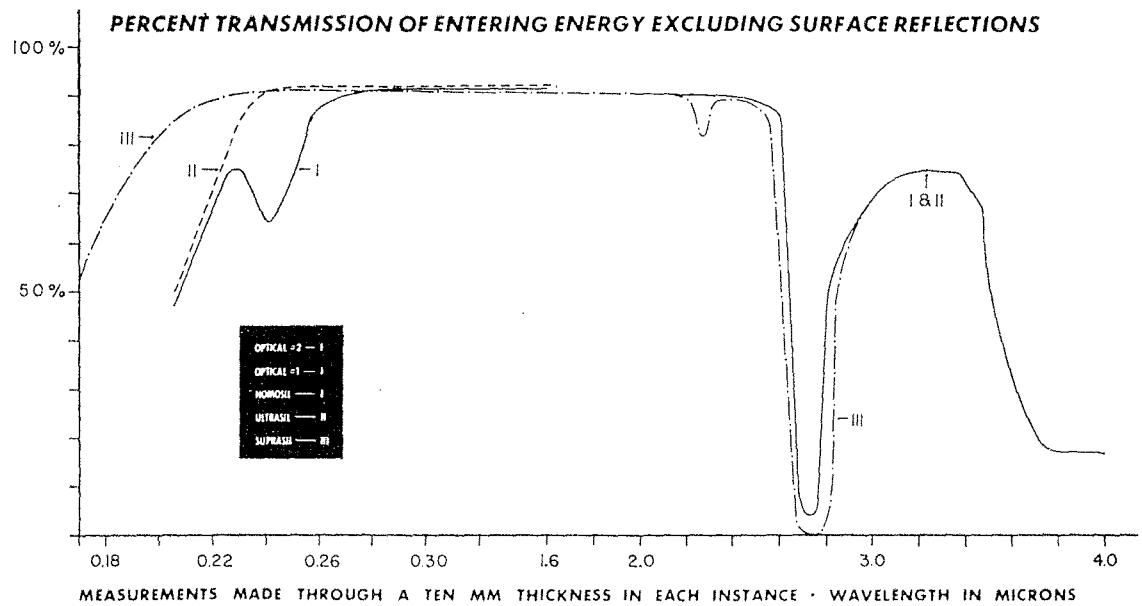
Fused quartz has replaced the natural crystal in most optics because of the decidedly improved transmission characteristics of the former, especially in the region 1650 to 2500A. The fused material, however, varies considerably and there does not seem to be a set of specifications for the industry. One manufacturer, Amersil Quartz Division of Engelhard Industries, Inc., Hillside 5, N. J., furnishes very informative details concerning their grades as shown in the graph below.

Note that Suprasil in 10mm thickness (the normal quartz lens is at most 5mm thick) transmits over 50% of the radiation at 1700A (0.17 microns) leveling off at about 93% from 2200A to well into the infrared.

The question of what grade of quartz you have in your spectrograph naturally arises. According to Amersil, there is a simple qualitative test based on fluorescence. If you shine an ultra-violet black-light (2537A) on the quartz in a darkroom, all grades of quartz, with the exception of Suprasil, will fluoresce. Optical No. 1 and No. 2 will have a faint blue fluorescence; Homosil a faint blue-violet and Ultrasil a faint green.

This naturally leads to another question. Does the fluorescence of quartz affect the background of spectrographic plates? It does seem likely. Littrow fog, which is ordinarily attributed to reflection from the collimating lens and the prism, may also partially come from the fluorescence of the materials. In grating spectrographs, if other than Suprasil or the equivalent is employed for condensing lenses and cover glasses, fluorescence may be responsible for some of the background, because most spectrographic emulsions are sensitive in the blue and green regions in addition to the ultraviolet. Here the SA#1 emulsion is an exception. It cuts off above 4500A, and is so insensitive to the green fluorescence, and a good deal less sensitive than other emulsions to fluorescence in the blue and blue-violet.

Until recently, quartz was thought of primarily for use in the ultraviolet but a recent development will extend its usefulness through the near infrared. A new grade of quartz called Infrasil is now available from Amersil. It does not have the characteristic absorption at around 2.72 microns. The new material should find many new applications in the near infrared.



CAST ALUMINUM SWATCHES

This is the third of a series of swatches planned to aid the spectrographer in identifying alloys. The first was of wrought aluminum and the set included 12 of the most common types. The second consisted of five different stainless steels. The newest set contains 12 cast aluminum alloys widely used in military and industrial applications. While the exact analysis of the swatches is not certified, the composition of each swatch is typical so the spectrographer may match unknowns against one of the swatches quite readily.

2001 **Cast Aluminum Alloy Swatches,** are 1-1/4″ x 3″ x 1/4″ thick. The alloy type is stamped on each swatch and a certificate giving the nominal composition accompanies each set. Comprises 12 of the most common sand and die casting alloys as follows: Almag 35, 40E, 43, 108, A108, 195, 214, B214, 220, 319, 355 and 356.
Set of 12 ..... **$25.00**

2000 **Wrought Aluminum Alloy Swatches,** are 4″ x 1″ x 1/8″. The alloy type is stamped on each swatch and a certificate giving the nominal analysis of the alloys accompanies each set. The pieces are looped on a beaded chain so that any swatch may be removed individually. Comprises all of the common wrought alloys as follows: 2S, 3S, 4S, 14S, 17S, 24S, B50S, A51S, 52S, 61S, 63S, 75S.
Set of 12 ..... **$25.00**

2100 **Stainless Steel Swatches,** on beaded chain, including a certificate giving the nominal composition of each swatch; each is about 4″ long x 1″ wide and 1/8″ thick. The set includes the following A.I.S.I. steels: 302, 321, 347, 316, 410.
Set of 5 ..... **$18.00**

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