surface coating with a sharp knife. This is accomplished by holding the knife at right angles to the sheet of roofing resting on a firm, level surface, and rapidly drawing the blade sideways under moderate pressure (Fig. 6). Care should be taken to avoid scraping entirely through the surface coating. This is important. Weigh the scrapings, and then dissolve in benzol. Separate the mineral matter by filtering or centrifugating, and wash with successive portions of benzol. Dry and weigh the mineral matter. Calculate the weight of bituminous matter in the scrapings by difference, and evaporate the combined benzol extracts on the water bath to exactly this weight, completing the evaporation if necessary in an oven. Both surface coatings should be treated separately in this manner. In Type D the bottom coating can readily be removed by cooling the specimen in an ice-chest and *rapidly* tearing off the burlap, which will carry most of the bottom coat with it. This should be extracted, filtered and the extract evaporated to obtain the pure bituminous matter present.

With Type F the central web of burlap can be torn out, and the bituminous matter contained in the cementing layer separated in the same manner.

With Type E the bituminous matter can be separated from the cementing layer between the sheets of felt, by cooling in an ice-chest, rapidly tearing the specimen in two along the plane of the cementing layer, scraping and separating the bituminous matter as described for the surface coatings.

Use the residues of bituminous matter for examining their physical and chemical characteristics.

TESTING THE RAW FELT

Ash—The ash is determined by incineration and expressed in percentage.

Fibers Present—The percentage composition of the fibers is determined microscopically by staining them with a solution of zinc-chlor-iodide (composed of 20 g. of zinc chloride dissolved in 12 cc. of water to which is then added 4 g. of potassium iodide and 0.1 g. of iodine), and counting under a microscope having a magnification of about 100 diameters. The individual fibers are recognized by their characteristic shapes and the colors to which they are stained by the zinc-chlor-iodide solution. The percentages are ascertained by counting the fibers in a number of fields and finding their average. The following classes of fibers are reported:

Rag Fibers	Cotton fibers—stained wine-red
	Wool fibers—unstained by the solution
	Jute and manila fibers—stained a yellowish brown
Paper Fibers	Mechanical wood pulp—stained lemon-yellow
	Chemical wood pulp—stained grayish purple to purple

"Number"—This is an arbitrary figure adopted by the trade, corresponding to the weight in pounds of a ream consisting of 480 sheets, each measuring 12 in. × 12 in.

Thickness—This is expressed in mils.

Mullen Strength—Since the raw felt is not susceptible to changes in temperature (as is the case with the finished roofing) it may be tested for tensile strength by means of the Mullen tester. The specimen is accordingly tested at room temperature by increasing the tension at a *uniform* speed of 2 lbs. per second until it ruptures.

Thickness Factor—This is equal to the thickness in mils divided by the "number" of the felt.

Strength Factor—This is equal to the Mullen strength in pounds divided by the "number" of the felt.

TESTING THE RAW BURLAP OR DUCK

Weight—In the case of burlap and cotton duck, the weight is figured in ounces per square yard, which is the customary way of designating these.

Thickness—Expressed in mils.

Mullen Strength—Determined as described for testing the raw felt.

BITUMINOUS COATING, SATURATION AND CEMENTING COMPOUNDS

These should be examined by means of the following tests:

Specific Gravity at 77° F.—Standard Method.
Hardness or Consistency at 115°, 77° and 32° F.
Fusing Point—Kraemer-Sarnow or Ball and Ring Method.
Volatile Matter—Standard Method.
Flash Point—Standard Method.
Saponifiable Constituents.

MINERAL SURFACING AND ADMIXED MINERAL MATTER

These should be subjected to a granularmetric analysis by passing them through a set of sieves and finding the percentage retained on the various sieves. Further knowledge can be gained regarding the character of the mineral matter, where required, by subjecting it to a quantitative analysis.

STANDARD PAINT COMPANY
WOOLWORTH BUILDING
NEW YORK CITY

TECHNICAL PHOTOGRAPHY AND ITS USE IN INDUSTRIAL AND COMMERCIAL ORGANIZATIONS

By JOHN H. GRAFF[1]

It is not the aim of this paper to discuss the different technical manipulations of photography, but to illustrate how photography can be used technically for better efficiency and to good advantage in science, engineering, industry, and commerce, and how it is needed not only in big corporations or large engineering or research laboratories, but how practically no concern is so small that it can afford to be without photography in one form or another. With the exception of a very few large concerns that had some sort of photographic department for the sake of photographing salesmen's samples, etc., there was until very recently no concern that had installed a photographic department as a unit in their business—a photographic department whose first and foremost duty it was to serve all the other departments and the company as a whole; the writer believes himself to be one of the first in this line. He installed such a department in one of the larger concerns of the country for the sake of efficiency in each and all of the departments, and the photographic department of this concern to-day serves over fifty different departments of the corporation, so that what was a dream three years ago is to-day a necessity which none of the departments could be without.

It is clear that to serve fifty different departments efficiently, many technical problems must be solved, and the manager of the new department must not only be a photographer in the fullest sense of the word, but also must have a general knowledge of drawing, engineering in its different branches, elementary chemistry and physics, microscopy, business management, buying, selling and advertising—in other words technical photography. Embracing all this, the writer hopes to see some day the "Photographical Engineer," who has had fundamental practical and theoretical college training for this purpose.

How, then, can technical photography be used in an industrial

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or commercial organization so that it justifies a department of its own? A photographic department as such is of little or no value if it is not fitted for the particular conditions for which its service is expected; but I can give in this paper only a general outline of how photography can be used to good advantage in almost any concern or corporation.

I—*To make copies, reductions and enlargements of maps, drawings, blue-prints, pencil sketches, typewritten matters, articles in magazines and books, photographs, prints, paintings, etc.* This may be done either by contact prints in a large printing machine —as blue-prints, maduro prints (brown), Umbra prints (black and white), etc., or by the reproduction method with the Photostat or similar machines, or through the direct photographic method on plates to be printed or enlarged afterwards. The first method, of course, is known to every engineer and almost all commercial men; the others, however, need some explanation.

I know of no better efficiency device than the Photostat; its uses are manifold for copying drawings, maps, typewritten matter, pencil sketches and blue-prints, and the work is both cheap, quick and satisfactory, if the originals are not larger than the copying board and the sizes of the reproduction are within the capacity of the machine. Patching different parts of a print together is in many cases not satisfactory, as proper registering of lines can never be done.

For larger drawings and prints it is necessary to use plates and it will probably some time in the future be possible to use films (ordinary Process or Process Panchromatic) for line work. From these, prints or enlargements can be made to any size required, but it is well to remember that all enlargements of drawings and maps, etc., should be soaked in a glycerin bath before drying, so that they will remain flexible and soft.

Other copying or reproduction methods could be listed, but I mention only the "Photo Copier " mostly used for copying letters or documents, where four different exposures can be made on a 4 × 5 plate, and the "Dry-printing method," whereby any tracing can be reprinted on tracing cloth, ordinary linen or any kind of paper in as many copies as wanted, and, as the name implies, the prints are not bathed in water or any kind of chemical solution, and are naturally free from all shrinkage.

But no matter which method is the most practical to use in any case, it is evident that it is of both direct and indirect gain to be able to reproduce any drawing or map to any scale or size required, to save the original drawings and standardize the filing system, to reproduce copies of blue-prints and pencil drawings without having to trace same, to get uniform copies of book and magazine articles for filing purposes, and to have exact copies of deeds, contracts, and other documents and specifications, free from all possible human errors or misunderstandings.

II—*To make photographic records of constructions, progress of constructions, machinery, tools, instruments and experimental apparatus.* This is of importance, not only for the engineer and contractor for use in reports, for filing and for future reference, but for comparisons, estimates, controversies, advertising and many other cases too numerous to mention. No engineer or department head in charge should be without a first-class hand camera, equipped with a good lens, and whether the service of a practical photographer is used or not, the responsible man in charge should at all times take a photograph of those observations which are worthy of report. It should be needless to mention that explorers, estimators, inspectors, commercial reporters and agents should always be equipped with the best of hand cameras and all of their reports and observations should be illustrated, the films or plates being developed, printed, classified, and filed in the company's own photographic department.

III—*To compile true and correct photographic data for controversies, court and accident cases.* Nothing can be better for a true record than a photograph, and nothing is more convincing in a controversy, court or accident case, than a correct photographic illustration of same. Still nothing can be more misused, for good and many reasons. Photographic copies of maps, etc., are time and again not accepted by recorders of deeds. Photographic exhibits are denied admittance in court cases and the judge gets the blame instead of the photographer. But how can anything else be expected? Photography cannot lie, but not all photographers understand photography in general, and technical photography in particular.

It is about time that a state or federal examination be required for a license to take photographs of this kind. To pass such an examination, it should be required that, besides being able to explain the principles of photography, the applicant also should know the following:

1—How to photograph a drawing to a certain scale.
2—How to place a drawing so that all straight lines will photograph geometrically straight.
3—How to light a tracing so that he does not photograph the wrinkles instead of the lines, or both.
4—Where to use a Process plate and where not to use it.
5—The different principles of ordinary, Orthochromatic and Panchromatic plates, and their uses.
6—The principles of color filters and how to use same.
7—The different actions of color filters under daylight and different artificial illuminations.
8—Construction and use of all practical photographic cameras and equipment.
9—The construction of lenses and their proper use, focal lengths, achromatism and apochromatism, etc.
10—Practical geometry and perspective.

After a thorough examination for colorblindness, the applicant should finally be required to promise, under oath, that he will make all such photographs to the best of his knowledge and with the correct equipment and material.

Until such a time arrives, money and time will be spent uselessly, and many a disappointment will be had, but the court will not be to blame. Corporation heads demand not only college degrees or some similar education of the most of the men in their employ, but for some even a state or federal license. Even milkmen must have licenses to deliver milk, but when it comes to making a photographic record, deciding right or wrong, loss or gain, almost any one who can put his head under a focusing cloth is good enough.

IV—*To prepare the right kind of photographs for newspapers, magazines or catalogues.* This, of course, is again more or less in connection with the advertising end of a business, but no business will do much independent advertising without finding that it pays both indirectly and directly to have this done in their own department under the proper supervision.

V—*Direct photographs for advertising and for salesmen's samples.* It has been proved that the best of printing on the best of paper is the cheapest and best advertising, and, by the advance of photography, a still better advertising medium can be used—the photographs themselves, in the following ways:

1—Collectively on exhibitions to the general public.
2—As educational demonstrations to the retailers or middlemen, as, for example, showing samples of window decorations, special products to be made of an article, methods of using same, comparison with inferior articles of competitors—different physical qualities, etc., in numerous ways.
3—As direct photographic samples of the articles where the real merchandise would be impracticable to carry in sample trunks. All of this, however, cannot be done intelligently if an outside photographer is employed. He must be in direct touch with the advertising manager and under him study the psychological points of not only their own advertising campaign, but also that of the competitor. He must be familiar with all points of manufacturing the products, know their technical and physical properties and fully understand how to illustrate the

selling points to the best advantage. In short, the advertising manager and the photographer must work hand in hand, and together bring the advertising campaign to success.

VI—*To make direct color photographs for lithographic cuts, salesmen's illustrations, scientific purposes and court cases, where true color renderings are of importance.* This, however, is new, but is fully practical if handled properly and in fact is much more advanced and even more used in Europe than here; it offers unlimited opportunities for the technical photographer. Catalogs and magazine advertisements can be illustrated with correct and beautiful color prints, a thing which was impossible before. It is of practical importance for records and scientific research, and, if properly done by one who knows how, is of inestimable value in court and accident cases.

VII—*To make lantern slides in black and white or through direct color photography for advertising or for collective departmental education of the company's employes.* Here again we meet a photographic problem which has great possibilities, but as an advertising medium has often been misused because it has not been handled with technical skill and has not been organized for systematic follow-ups. As an advertising medium it is not only available for the manufacturer and wholesaler but also for the small merchant and retailer, in particular if directed and prepared by the manufacturer.

As an educational medium, lantern slides are invaluable. Such education not only raises the standard of the employees from the lowest to the highest, but it gives each one better understanding of his particular work in his own department and of his relation to the company as a whole. It brings all new methods and things of daily business interest before him and gradually elevates him from an ordinary laborer to a live unit in his department, so that, before long, he works for the pleasure of it and to advance the work itself.

VIII—*To make photomicrographs for scientific research and comparison of raw materials, and to record all microscopic observations not only for scientific purposes but also for manufacturing, buying, selling, and advertising.* The scientist has, for many years, made photomicrographs for his own particular scientific purposes and educational demonstrations, but it took a long time before this work began to be of any commercial value. To-day, however, with the strict demand for efficiency, the close competition and the almost undetectable substitutes of every kind of merchandise, commercial photomicrography is a necessity—the greater the business, the greater the need.

We must realize that nearly all physical and many chemical differences, no matter how small, can be detected with a microscope; and, therefore, they can be photographed and standardized.

Microscopic observations can be interpreted only by those with special training and long practice with same, but a photomicrograph can readily be understood by any intelligent man, in particular if he can make comparison with other photographs of standardized examples of the same product. Many commercial objects have already been standardized in their different forms and compositions and photographic charts of these can be bought with full descriptions for comparison, but much is yet to be done and in many cases each one must work out his own solution. If intelligently done and if proper records are kept, it will not be long before photomicrographic work will be of immeasurable value for comparison in manufacturing, for protection and checking in buying and awarding bids and as illustrative explanation in advertising and selling.

Many more uses of photography could be mentioned, but the subject is so many-sided that each industry and commercial establishment must be treated separately, if a true and convincing proof of its need for technical photography should be made.

How large, then, must a concern be before it has practical use for a photographic department?

Not all industrial or commercial concerns need or can afford a $5000 equipment, but no up-to-date business of any kind, efficient and worth its salt, can afford to be without a photographic equipment of some kind. What the small industrial and commercial man cannot afford to do alone, he can do through his Chamber of Commerce, manufacturer, wholesalers' or jobbers' society; and no commercial association or agency for mutual benefit to members, either for importation, exportation, general distribution or what not, can afford to be without a photographic equipment if it aims to give efficient service.

"But who, then," I have been asked, "shall take care of my photographic work? Technical photographers evidently do not go begging for work, and besides I want to experiment only gradually and spend a small amount for an equipment."

Technical photographers are not born, and the best man any one could get, to start in an experimental way, would be a live young man already in one's employ, interested in the business and with intelligence and education enough to find what he is lacking, learn and apply the knowledge he acquires. For bigger concerns, however, the problem is more difficult, but there are intelligent young photographers to be found who are educated enough to apply themselves to technical and commercial problems, and, on the other hand, technical men are more and more taking up photography; it will not be long before the "Photographical Engineer" has a recognized profession.

How shall the beginner and experimenter properly select his equipment, arrange the room he can spare, select his material and get the proper instructions, so that no more money is spent than necessary?

Looking at it from the standpoint of advancement of photography, no one will be better situated and served than the industrial or business man who takes up photography for his own use. The manufacturers of photographic materials and instruments, from the very beginning of photography, have built their success on practical and thorough demonstrations to each individual user of their material. When amateur photography advanced, literature of the most instructive kind was freely distributed, traveling schools were organized and equipped and sent from city to city all over the country, giving demonstration lectures free of charge and for each advancement in photography new subjects were added. Just so, when the demand comes from the industrial and business man, he will not only be offered all the experience of photography in general, but his own point of view will be studied to assure the best possible fulfillment of his requirements.

As the engineer to-day orders a certain machine to fit his own local conditions, demands a certain capacity and so much to spare in case of increase of production, specifies drawings, costs, etc., the business man can to-day simply state his requirements in photography, the room he has to spare, cost limitation and his possible future demand, and he will not only be supplied with material fitting the conditions specified, but, when eventually decided, an expert will install the equipment and not leave the place before everything is understood and runs smoothly.

Photography applied to science, engineering, industry and commerce has come to stay.

CHAIRMAN'S ADDRESS[1]
FERTILIZER DIVISION AMERICAN CHEMICAL SOCIETY

By J. E. Breckenridge

There has been some discussion as to the advisability of holding meetings during the war time, but it seems to me the

[1] Presented before the Fertilizer Division at the 55th Meeting of the American Chemical Society, Boston, September 10 to 13, 1917.