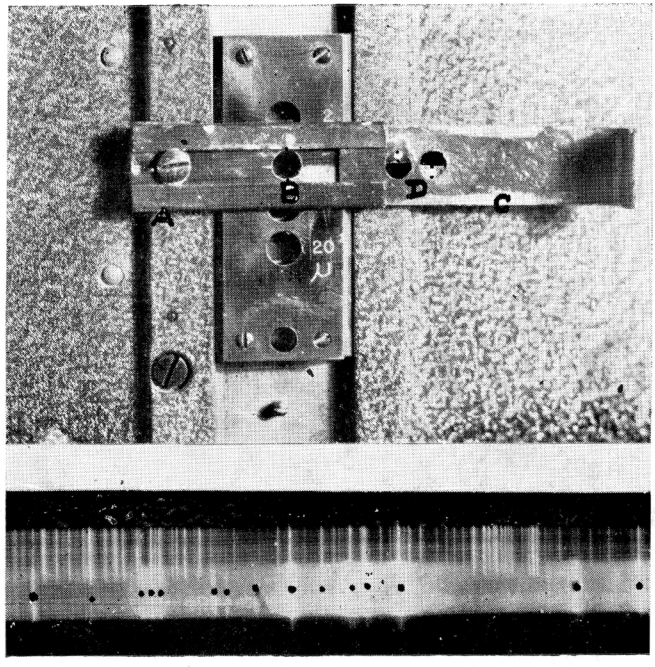
THE TECHNICIAN IN THE POLICE LABORATORY



VOL. 1—NO. 2

JUNE, 1943

A scientific publication, issued monthly by the Laboratory of the Missouri State Highway Patrol, through the interest and cooperation of police laboratory technicians throughout the country. "THE TECHNICIAN" is a non-profit, and non-copyrighted bulletin, edited by the personnel of the M.S.H.P. Laboratory.

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THE COVER

This month's cover photograph is one submitted by Joseph Beeman, M.D., Director of the Oregon State Police Laboratory, and accompanies his article on the small Littrow Spectrograph, presented in this issue.

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TO THE READER--

One month ago, a little delayed, and perhaps not so large as it might have been, "THE TECHNICIAN" was introduced into the field of Police Science Literature.

When the response to it has been determined, we will discuss that reaction in these pages.

Our first issue was mimeographed. Costs of printing a publication of this sort, particularly when they must be paid entirely from subscription fees derived from such a small group within the police profession--are excessive. It is possible that we will obtain a greater number of subscriptions than is expected. If so, printing facilities may be obtained or arranged for. Perhaps some other department has such facilities and will cooperate with us in this venture. Reproduction of photographs is possible at present only on a limited scale.

If an organization or society is formed and this publication accepted as its official bulletin, printing facilities, supported by advertisement, could readily be obtained. The Highway Patrol is naturally prohibited from engaging in commerical enterprise. Should we accept commercial advertisement, even though merely for the purpose of defraying printing costs, such action might result in criticism.

If "THE TECHNICIAN" were published in the name of an organization, as its official bulletin, there could be no objection to such a move.

The reader may wonder why we have undertaken to initiate a publication on so insecure and indefinite a basis.

The answer lies in the fact that we hope that "THE TECHNICIAN" will be of such interest to the police laboratory technicians and others throughout the country, that they will see to it that it is properly supported. The growth and character of the publication rests in their hands. The Laboratory of the Missouri State Highway Patrol has organized tentative plans for, and has begun the distribution of it. However, it is to be regarded as a publication by and for technicians everywhere. It is yours.

not ours. Your suggestions, criticisms, and comments will be appreciated. They will be carefully considered, and if thought practical will be incorporated into the publication, "THE TECHNICIAN" should be looked upon more or less as a corporation, in which each of you, the readers, has purchased stock. As more effort, time, and money, is put into the "corporation" so will the value of that stock increase. "THE TECHNICIAN" will then be as a mirror, reflecting the attitude, views, and opinions, of the entire technical phase of the police field.

We note with interest the announcement in the March-April, 1943 issue of the JOURNAL OF CRIMINAL LAW AND CRIMINOLOGY, of the formation of an "American Society of Questioned Document Examiners." Again is brought to us the realization of a need for a similar "American Society of Police Laboratory Technicians."

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We, the editors, are not magazine publishers. Our training has been in the analysis of physical evidence found at the scenes of crime, and in the preparation of that material for use in the Courts of Law. If we seem at times to lack skill in the handling of literary material, or if the importance of other duties imposed upon us causes delay in printing and distribution of the publication, it is hoped that our readers will be tolerant. We will do our best to express the interest and attitudes of the various workers in the field. We will continue our efforts to encourage a better cooperation between these workers. To advance suggestions on standardization of practices, and to encourage the formation of a society which will represent these interests.

THE EDITOR.

MAGNIFICATION vs. DIAMETERS

By John E. Davis
Technician with the Laboratory of the Missouri
State Highway Patrol

In reading articles of a scientific nature, one often finds difficulty in interpreting the author's illustrations due to variations in the methods used for the expression of magnification of photomicrographs.

Probably some of this difficulty is actually due to the writer, who may fail to properly label his illustration--that is, he may use an incorrect term in expressing the magnification, not realizing that there is any difference in the meanings of the various modes of expression.

On the other hand, probably it is more frequently the fault of the reader who does not know just how the caption should be interpreted, either because he likewise does not know that the expressions vary in meaning, or because he is not sure that the writer correctly expressed himself.

Just for example, let us suppose that an illustration appears in a text, and is labeled as follows: "Photomicrograph of _____. 60-X." Now just what does "60-X" mean? To the reader who may never before have seen the particular object represented by the photograph, but who has some knowledge of microscopy, he will probably conclude that it was taken with a 10-x objective and a 6-x ocular, which gives a magnification of approximately 60 diameters. This may be the correct interpretation, and it may not be. A second reader may infer something entirely different from the designation. To him, the caption will mean that the illustrated object--as it appears in the text--is 60 times as large as is the object itself. And one reader may think of it as 60 times as large in area, another as 60 times as large in diameters. Of these, the latter view would be more likely to be correct. But then there appears a second question. Namely, did the caption refer to the size of the illustration in the text, or does it refer to the size of the original photograph submitted with the manuscript, which may have been much larger

than that appearing as an illustration in the text.

It may appear, then, that 60-X, or 270-X, or 900-X, does not satisfactorily express the author's meaning to a reader. Particularly may this be true in those cases in which the reader is not likely to have had a scientific background, but in which he does desire to correctly understand the photographic illustrations.

If the author has not, at outset, explained just what he means by the expression he has used in designating "magnification", then they might almost as well be left off. And how many times does one see such explanations in the texts?

A second method, commonly used for the expression of "magnification" is the term "diameters".

This mode of expression is probably somewhat better than the use of "X", for at least it excludes the interpretation which might be made regarding area. Otherwise, however, it involves the same difficulties of understanding.

"100 Diameters", may mean that the author used a 10-x eyepiece, and a 10-x objective in making the original negative.

It may also mean that the diameter of the object as seen in the print (in the text, or in the manuscript--??) is 100 times as great as it was in the original object.

Which is the correct meaning? Probably the former, but if no explanation is given how can the reader be certain?

A third method of expression may be utilized. This is by use of the word "magnification". Thus a photomicrograph may be designated as having a "magnification of 100".

To the reader, this may have less meaning than "diameters", and be of no more significance than if the expression had been as "100-X".

A fourth method might be used. This would be by a designation, not of the illustration or anything about it, but rather of the objective and ocular used in producing the negative. Thus a picture would be represented as a "Photomicrograph of ____, 10-x; 10-x." or as "45-x; 10-x." etc., in which the power of the objective were first given, to be followed by the power of the ocular.

This method would be the only one which could satisfactorily express to a reader the "magnification" of an ob-

ject in the absence of any explanation of the authors meaning. It has a disadvantage, however, in that it presupposes a knowledge of microscopic lenses on the part of the reader. Even so, it is probably better than the above mentioned expressions, yet it is seldom or never used.

What solution can be offered, then, which will provide for these difficulties?

There are two. In the first place if magnification is going to be expressed by any of the first three methods discussed above, the author should state explicitly just what he means by the expression he has chosen to use. Secondly, there should be established a more uniform meaning for these terms, and a standardization on the use of one or more of them, in which each expression has a particular and like meaning, both to the reader and the author.

Let us consider for a moment the compound microscope. The designation of the power of the objective, and of the ocular, represents an expression of the relative diameters of the image produced with that lens, and of the diameter of the object itself.

Accordingly, when using a 10-x objective, we know that the objective is magnifying the object ten diameters. If a 6-x eyepiece is used (an eyepiece magnifies the image produced by the objective, and not the object directly) this eyepiece magnifies the object-image 6 times, so that a final magnification of 60 results.

Now this expression of "60" as a final magnification is purely arbitrary--something which is not fully realized by many individuals who use the microscope. It does, however, express approximately the relative size of the image as seen by the individual looking into the instrument, with the size of the actual object being examined. More precisely, it expresses the diameters of the image as it would appear at a distance of 250 millimeters from the "Ramsden Disc".* This would be a little over 250 millimeters from the upper surface of the ocular itself.

To properly express magnification of a photomicrograph, it must be expressed in terms of the relative size of the image as it appears in this particular plane, and the size of the object itself. Hence, for accurate designations, it becomes necessary to calibrate ones objectives

and oculars by projecting onto a ground glass screen placed in this position, the image of a stage micrometer or other convenient scale, and measuring with a caliper, the diameters of the image produced. For this reason the true magnification--as thus determined--may be somewhat different from a mere multiplication of the powers of the objective and oculars, inasmuch as they can only be made so accurate. A 10-x; 10-x system might therefore give an actual magnification of only 95 diameters, rather than the 100-x which would be obtained by mere multiplication.

In making these determinations and calibrations, the body-tube of the instrument should be accurately set. (170 mm for the Leitz instrument, 160 for others)

There are two types of magnification. One is magnification with resolution, (which might better be termed "angular magnification"); the other is empty magnification.

When one uses a hand-lens, or a microscope, not only does the image appear larger than the object being examined, but detail is brought out which could not even be seen with the naked eye. This is resolution. The ability of a lens system to show as separate and distinct, characteristics which were only visible "en masse" with the naked eye, is a feature of its "resolving power". The higher the resolving power, the greater the amount of detail which can be seen by its use.

"Empty magnification" is mere enlargement without any increase in the amount of detail which is discernable. If a negative is put into a photographic enlarger and "blown-up", it is enlarged, but no new detail is discernable which was not apparent in a smaller print or in the negative itself. It merely has spread the whole image out over a larger area and made it less difficult to observe the smaller points.

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*The "Ramsdon Disc" is the point or region at which the light rays leaving the eyepiece cross to form the inverted cone of light rays which produce the image. Light rays leaving the upper lens of the ocular are convergent. They therefore cross at a point just above the ocular, and "fan" out in the form of an inverted cone. The point at which they cross is known as the "Ramsdon Disc" or "Ramsdon Circle". It is not a point, but rather a small circle or disc.

In the microscope, it is primarily the objective lens which does the resolving. Consequently the objective is more important than the ocular from that standpoint.

As illustration of this, if one takes a certain objective and examines something just within the limits of its resolution, and then changes to a lower eyepiece, while the apparent size of the image will be decreased, the resolution will appear to have remained about the same. The effect on resolution, of the eyepiece, is relatively small.

In expressing microscopic magnification, we must express it in such a manner that some indication is given of the resolution obtained, and not so much as to the apparent image size. It is just for this reason that the plane at which magnification is measured (250 mm from ocular) is fixed and the same regardless of the lens system utilized.

If we should set a microscope up with a 10-x objective, and a 10-x ocular, and project the image exactly to 250 mm. from the Ramsden Disc, if the lenses were perfect, the diameter of the image would be exactly 100 times the diameter of the object. Further, there would be apparent a certain amount of resolution--that is, detail would be visible which could not be seen by naked-eye examination.

If we should now move our ground glass out to 500 mm. from the Ramsden Disc, the image would appear 200 times as large (diametrically) as the object itself, and twice as large as the image had appeared at 250 mm from the Disc. However, no increase in resolution would be observable. The correct magnification of the object is still "100", and not "200" as some might suppose.

In order to get a magnification of 200, it would be necessary to choose an objective of 20 power, and an ocular of 10 power, and then examine the object. If the image of this were viewed on a screen 250 mm from the Disc, it would appear as large diametrically as the other image (mentioned above) had appeared at 500 mm from the Disc. However the resolution observed in this image would be greater than that which had appeared with the previous lens system; magnification would be correctly expressed as 200.

It is just for this reason that we use higher and higher power objectives. If such were not true, it would only be necessary to move the negative farther away from, or closer to, the Ramsden Disc to increase or decrease true magnification.

From this we see immediately that magnification of photomicrographs can be correctly expressed only in terms of the relationship between the actual size of the object, and the image as it would appear at a distance of 250 millimeters from the Ramsden Disc. Regardless of the size of the negative, or of the prints made from that negative, or of the reproductions made of that print, magnification will be correctly expressed, (practically speaking) if the author has designated it in terms of the image in this one particular plane.

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For ordinary purposes it is satisfactory to merely multiply the powers of the objective and ocular together, inasmuch as extremely accurate designations are not generally necessary, and since the powers listed, are generally roughly accurate.

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Let us now take up the consideration of the term "diameters". It is the writer's view that this term should be reserved solely for an expression of the relative size of the actual object and of the apparent size as it is viewed in a print or reproduction. Hence, no idea of resolution would be obtained, nor any knowledge of the amount of resolution which was present.

Expressing the facts in terms of "diameters", then, one would see that the image of the 10-x; 10-x lens system at 500 mm. from the Ramsden Disc, would be the same as if a 20-x; 10-x were used and the negative placed (or the image viewed) at 250 mm. from the Disc. Both would have a diameter expression of 200. Nothing would be implied as to resolution. If these images were photographed, and these prints reproduced only half as large (diametrically) in a text, then the diameters would both be 100.

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The same would be true of any negative placed in an enlarger and increased diametrically in the print. If a 4 x 5 inch negative is used to make an 8 x 10 print, we have increased the "diameters" of the image. No resolution has been added.

If this original 4 x 5 negative had been exposed at 250 mm. from the Ramsden Disc, and a 45-x; 10-x lens system used the magnification would be 450. If a contact print were made,

the print would have a magnification of 450. The 8 x 10 enlargement, however, would have a magnification of 450, but a diameters expression of 900.

From all this, it becomes apparent that, unless an author chooses to specify exactly what he means by his expressions, that he should use both methods in combination--that is, designating magnification first--as expression of resolution, and diameters secondly as expressing the relative size of the image which the reader will see and the diameter of original object pictured.

We will then have more or less standardized on a mode of expression which will present illustrations in their true light.

"Magnification" must refer primarily to resolution, and thus be an expression of "angular magnification", whereas "diameters" must be reserved for expression of relative size, regardless of the angular magnification.*

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Reference to the illustration presented below will clarify the discussion.

Position "A" has a diameter equal to that of "C", and twice that of "B". If the diameter of "A" is 2 inches, then that of "B" is only 1 inch. That of "C" is likewise 2 inches.

The "Diametrical magnification" then, of A and C are identical, and that of B is only one-half.

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*Such angular magnification would mean more if the power designation of the lens systems employed were also listed, for a 10-x; 10-x system would give the same angular and diametric magnification as a 20-x; 5-x system, yet the latter (due to the fact that the objective would probably have a higher resolving power) would show a greater final resolution. Accordingly, photomicrographs would be listed as "45-x; 10-x, 200 diameters", or any other number of diameters depending on the size of the print. If more accurate expression of the magnification was desirable, the actual calibrated angular magnification should be presented also, as 45-x; 10-x, 429 magnification, 200 diameters". Complicated?--Yes, but meaningful.

The "Angular Magnification" however, of A and B are identical, whereas that of C is twice that of these two.

An image at position A, with a diameters of 2 inches, is not equivalent in resolution to an image of the same object at C, with an identical diameter.

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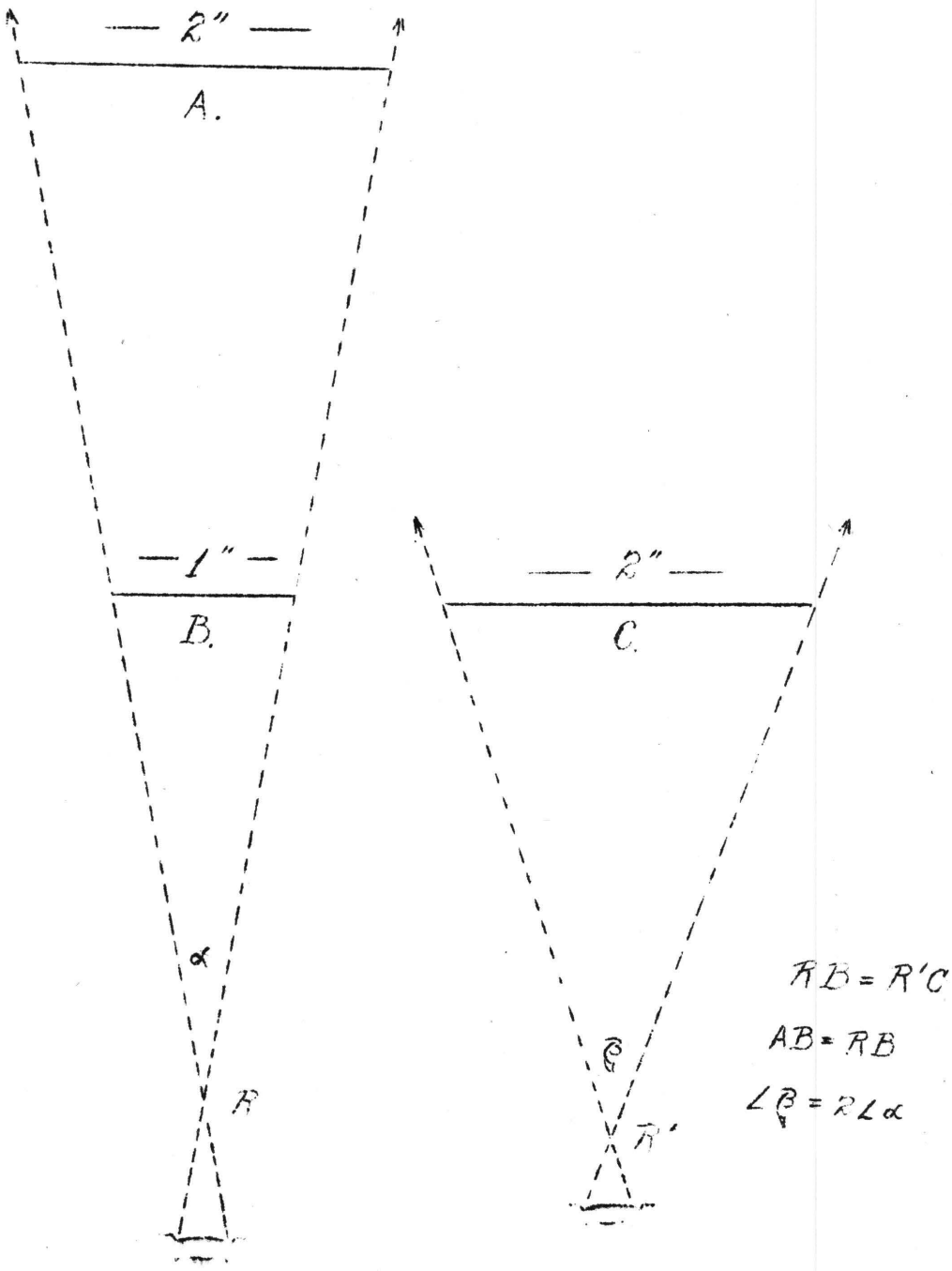
It may be of interest to briefly discuss the methods which might be employed in the determination of "diameters" of a print.

The diameters of an object as it would appear on the ground glass screen will vary directly as the distanc from the Ramsden Disc. Thus, at 500 mm. from the Disc the image will be diametrically twice as large as it would be at 250 mm. Consequently, it is a simple matter to calculate the "diameters" of an object on any print made, by first calibrating the lens system and then figuring out the relationship between the size of the object in a finished print, and the size of the image at 250 mm. or of the object itself.

Suppose that a stage micrometer is used, and the image projected on a screen at 250 mm. using a 10-x; 10-x system. Let us assume that a measurement shows two lines 0.01 mm. apart on the stage micrometer to appear 1.0 mm. apart on the screen. The magnification is then exactly 100. At this point the diameters is also 100. At 500 mm. from the Ramsden Disc, the magnification will still be 100, but the diameters will be 200, for there the lines will appear to be 2.0 mm. apart. At 125 mm. from the Disc the magnification is still 100, but the diameters is only 50 inasmuch as the lines now appear to be 0.5 mm. apart. Should this last image be photographed and the negative placed in an enlarger, by enlarging two diameters the "diameters" in the print would be 100, and would show just as much detail, (practically speaking), as would a negative placed originally at the 250 mm. plane, other things being equal, (film emulsion, lens qualities, etc.)

If one uses a camera which always remains in the same position, (as with some of the Leica attachments e.g.) a stage micrometer may be photographed, and this photograph compared by measurement with a measured image of the scale at 250 mm. and the diameters of the negatives taken at that


— 2" —
A.
— 1" —
B.
α
R
— 2" —
C.
β
R'
RB = R'C
AB = RB
∠β = 2∠α

position always known. The by projecting this scale onto a rule, one can adjust the position of the enlarger lens to produce images of any desired "diameters".

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In making the calculations, a formula such as the following may be used:

$$\frac{\text{True magnification of the object as calibrated at 250 mm from Ramsden Disc.}}{250} = \frac{\text{"Diameters" of the image as viewed at any other distance from the Disc.}}{\text{Distance in millimeters from the Disc to the point at which the negative is placed or the image viewed.}}$$

This, of course, gives the "diameters" of the negative, and not of final prints unless they be made by contact printing.

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A MODIFIED HARTMANN DIAPHRAGHM FOR USE WITH THE BAUSCH AND LOMB SMALL LITTROW SPECTROGRAPH

By Joseph Booman, M.D.*

The Bausch and Lomb Small Littrow Spectrograph has been utilized by some police laboratories because of its sensitivity and relatively low cost. One disadvantage of the instrument is the difficulty in the comparison of spectra to determine identity or to accurately measure wave-lengths. To overcome this difficulty in part, a modified Hartmann diaphraghm was constructed in this laboratory and has been in satisfactory use for over two years. No originality is claimed for the use of the Hartmann diaphraghm by which spectra may be directly compared; it is a well known device on the larger spectrographs. The low cost and simplicity of the device we are using suggests that it may be of value to owners of the Small Littrow Spectrograph.

Figure 1 is a view of the diaphraghm. A fixed metal channel (A) is constructed from a small name-plate holder; this is attached to the spectrograph by means of the center screw on the front of the instrument. A hole (B) 3 mm in diameter is drilled in this channel directly in front of the slit opening. A sliding piece of metal (C) has two 3 mm holes (D) drilled in it. Over the top half of one hole and the bottom half of the other hole is soldered a strip of metal. White dots indicate when either of the holes is in front of the slit.

In use, a spectrum of one substance is taken through the hole with the top half covered, the sliding strip is slid over until the hole with the bottom half covered is in front of the slit and a second comparison spectrum exposed without moving the film holder. Figure 2 is a spectrogram (positive) of a silver alloy containing lead (top) and lead (bottom) taken through this diaphraghm; the coincidence of the lead lines is apparent.

*The author is the Director of the Crime Detection Laboratory, Department of State Police, University of Oregon Medical School, Portland, Oregon.

Editor's Note:

Application of the spectroscope and spectrograph to police laboratory problems is of especial interest. Discussions of problems, and cases in which the spectrograph is used or has proved of value would be appreciated. We have noted in past issues of the B.C.I. Bulletin of the New York State Police a frequent reference to application of the spectrograph in analysis of soil samples.

Original research problems in this field are numerous. Without doubt, we in the Police Laboratories have hardly "scratched the surface" as regards application of this instrument to criminal investigation.

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* TECHNICAL NOTE *

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* We note a tendency in writings (both from this *
* laboratory and others, to use the terms "blood-group" *
* and "blood-type" more or less interchangeably. Act- *
* ually the term "Blood-type" should be used in refer- *
* ence to the "M" and "N" factors, and not in refer- *
* ence to the "A", "B", "AB", and "O" factors. In the *
* more recent writings of the serologists may be seen *
* the more precise use of these terms. Probably they *
* were used indiscriminatly before discovery of the *
* sub-groups. However, insofar as is possible we *
* should follow the terminology of the particular ex- *
* perts whose work it is to formulate the "rules and *
* regulations" of any particular field. Accordingly, *
* the term "blood-group" would designate the "A" and B" *
* factors whereas "blood-type" would designate the "M *
* and N" factors. *

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Foreword by the Editor:

Generally speaking, the handling of physical evidence--that is, the search for and preservation of it before transmittal to the laboratory--is not the job of the laboratory technician.

In the future, as the necessity for correct preservation of evidential material is more fully realized, possibly it will be more common to find the laboratory man assigned to the collection of evidence as well as to the analysis of it. Such a procedure would have both advantages and disadvantages, neither of which will be mentioned here.

At the present time, it is usually the duty of non-technically trained investigators to search for and preserve evidence. It is not only necessary for them to become aware of the proper procedures to follow in handling that evidence, but they should also have a knowledge of what determinations the laboratory can make on that type of evidence which they have collected. It is the logical province of the technician to inform the investigator as to the probable significance of his evidence.

It is for this reason that we include in "THE TECHNICIAN" discussions of the correct handling of evidence, and the relationship of the laboratory to the investigator. The non-technical reader may benefit directly from the discussions; the technical reader will learn something of the methods which he may follow in informing others of these facts. The work of the laboratory technician is so closely associated with the physical evidence brought in for analysis that he can scarcely afford to disregard the manner in which it was handled prior to his receipt of it.

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The following article, submitted by R. F. Borkenstein, is the first of this type to be printed in these pages. Others will probably follow.

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CRIMINAL INVESTIGATION AND THE POLICE LABORATORY

By R. F. Borkenstein
Director of Indiana State Police Laboratory

The use of scientific aids in both criminal and accident investigation has come to the front in the past decade, and now a progressive court expects officers presenting cases to use every means available to present the facts as thoroughly and graphically as possible. A witness can testify that he saw some spots which might have been bloodstains, but how much more impressive it is to show a photograph of the location of the spots and employ expert testimony to the effect that analysis of the spots show that they are blood, and furthermore are human blood.

A medical doctor uses a few of the simpler instrumental aids himself, such as a stethoscope, but if the requirements in a diagnosis are more complicated, he depends on the clinical laboratory. It would be very difficult and hardly satisfactory for him to make his own Wasserman tests, X-Ray examinations, etc. These should be left up to specialists. The laboratory is brought into use whenever he wants to gain a knowledge of something that is beyond his ordinary senses.

The investigator can only see or learn a limited amount from a careful visual examination of a crime or accident scene. He can usually find many bits of evidence which might be of some value, but he often cannot really know how valuable in his own mind. The laboratory may then come to his aid.

There is a certain art in knowing how to use the facilities of the laboratory. First, it is necessary to know what can be done, and second, how to prepare evidence for the laboratory in order to preserve the evidential integrity of the material being submitted. A good investigator will want to know the facts rather than to guess.

It is obviously impossible for every police department or sheriff's office to maintain a laboratory. A complete police laboratory is quite extensive. No two cases are exactly alike, and every known science and technique can be used to advantage at some time. The usual police laboratory is equipped to handle all of the common tests and examinations

and to know where to go for those that go beyond its scope. The greatest virtue that any investigator in the field or any technician in the laboratory can have is the ability to realize and accept his limitations, and to use specialists to take up where his ability leaves off.

Scientific methods do not replace the old routine methods of investigation. They simply take up where the older methods leave off.

If, during the course of any investigation, a confounding situation arises which puts a question mark in the mind of the investigator, or that would make his opinion a guess, all possible means to clarify the point should be used and these means might be of scientific nature.

Laboratory examination of physical evidence makes it possible to know what happened, making it unnecessary to assume what happened.

The reasons for which the facilities of the laboratory have not been used more are that there is a certain amount of prejudice against this type of evidence among old time police officers, lack of knowledge of what can be done, and a defeatist attitude among investigators which causes them to give up before exploring all the possibilities.

The cardinal rule in handling evidence for technical examination is proper preservation and maintenance of a record of the continuity of possession. Carelessness in this regard can render useful evidence valueless. Attorneys in attacking evidence, can either disqualify evidence which cannot be properly traced, or can at least destroy a large part of its evidential weight. Evidence should be put in sealed containers, and each piece marked by the investigator. Then in court he can identify this gun or this knife or this bullet as the one he submitted. It is a mistake to try to identify an object by appearance only, as there might be many duplicates. Serial numbers should be recorded if there are any. The evidence should be in the custody of as few people as possible, so that a whole line of witnesses to identify the evidence in court is not necessary. Bullets should be scratched with small initials on the base end, cartridge cases on the inside, the serial number and make of a gun should be recorded. Pieces of wood or punches should have labels securely fastened to them. Initials should either be written on or scratched in the surface of the objects. Blood samples should be put in

clean bottles with gummed labels attached. If the material is to be sent by mail, the package should be registered. It should then be submitted as promptly as possible. A record should be kept of when the evidence was received and when it was surrendered and to whom. Wherever possible, photographs should be taken of the scene of a crime or accident to record the details. Photographs make long detailed explanations unnecessary and give each juror and the judge the same mind picture of the scenes, while verbal testimony creates a different picture in each mind. They also tend to unify the testimony of witnesses. Anyone with experience in court is well acquainted with the notorious variation in witnesses' stories.

There are two general classes of tests available in the laboratory. First is the group of investigative aid tests that help the investigator tremendously in his investigation, but that are not conclusive enough to use as evidence against an individual in court. In this group fall the following:

1. The polygraph, or lie detector. The records themselves are accurate renditions of the emotional stress of the individual being tested, but in many cases there will be stimuli that the subject does not wish to reveal, but that might not concern the case at hand. A fifty cent dishonesty might cause a violent reaction in an individual accused, but innocent, of a $500 burglary. The accuracy of this test is about 95%.

2. The benzidine test for the identification of blood stains. This is a very simple test. If the test is negative, it is conclusive, but a positive reaction must be verified by further tests.

3. The Lungo test for detection of nitrate particles on the hands of persons suspected of having fired guns. This is a very non-specific test that might be useful in certain cases, but that should never be used in court.

4. Hair comparisons. Many things can be told from hair. First, is it vegetable or animal fiber; second, is it animal or human; third, is it from man or woman; fourth, was it pulled out, cut off,

or did it fall out naturally? Adhering dirt might help; the color; the amount of curl might be of use.

5. Many microscopic comparisons show what probably is true, but they are not absolutely specific. Two samples of paint might be alike in color and composition, but this does not mean they came from the same car. A certain amount of judgment should be used in estimating the evidential weight of any evidence.

The second group of available tests includes those technical examinations that are absolutely specific; in fact, so specific that the technician can go into court and be certain that his testimony is true and accurate. In this group fall:

1. Firearms identifications. As long as the evidence is in reasonably good shape, it can be definitely shown that a certain bullet was or was not fired from a certain gun, and that a certain cartridge case was or was not fired in a certain chamber. It is also possible to tell the distance the muzzle of the gun was from the victim up to about 20 inches. This in many cases will verify or contradict testimony involving hand to hand struggles. The outer layer of clothing is necessary for this test. Visual observation is not sufficient for this purpose, as much of the evidence is invisible without chemical analysis.

2. A sample can positively be identified as human blood by the sensitive Precipitin test. This is a serological test. If a sufficient amount is available, the sample can also be typed. Samples that type differently cannot possibly have come from the same person, but samples that type the same might have come from the same individual or other person whose blood would type the same.

3. Many chemical tests. Tests for poisons are conclusive. A very sensitive test, the Florence test, is available for the detection of seminal stains.

4. The many physical comparisons. It is possible in many instances to show whether a certain punch did or did not make a given impression, whether a certain pair of cutters cut a certain piece of wire, whether two wires are from the same piece, whether two pieces of cloth are the same, whether two pieces of glass are from the same source, etc.

5. Chemical tests for intoxication. These methods have been proven time and time again in practical use. Breath analysis (Drunkometer to determine blood alcohol) should be used in the case of living subjects because of ease in obtaining the specimens and speed in operation. A complete test and analysis seldom takes over 10 minutes. Direct analysis of the blood should be used in fatalities. Special bottles are furnished on request that contain the proper preservative. These samples should be kept on ice and submitted to the laboratory as soon as possible.

6. Fingerprints. Latent fingerprints should be powdered and lifted with scotch tape and put on a piece of fixed cut glossy photographic paper. The taking of proper fingerprints must be taught by demonstration.

7. Document examination. Handwriting for comparison should be accompanied by as much actual writing of the suspect as possible. Comparison of typewriting samples can also be made.

The equipment for infra-red, ultra-violet, and X-Ray examination is also available, but their use is rather limited, as most tests for which they can be used may be done better by microscopic or chemical means.

Technicians are always ready and willing to aid in this part of an investigation, and should be considered as consultants.

It is always better to try to use evidence and then fail, than to not try at all, as many cases have been broken by details that normally would be overlooked.

Items Which May be of Interest:

While the identification of various materials commonly encountered in police laboratory work is fairly well covered in the general criminological literature, it frequently becomes advisable to obtain some information on the characteristics and identification methods of materials not commonly examined, nor usually related to criminal activities.

It has occurred to us that "THE TECHNICIAN" might serve as a "clearing house" through which information could be obtained as regards publications or literature on specific material which would be of interest to individual technicians.

Police laboratories generally have on hand a number of pamphlets or books, containing information which would be of interest to others. The different laboratories are aware of different sources for such literature. Government publications, and government testing laboratories, for example, provide a convenient source for a great deal of technical information.

Other similar sources are known to our readers.

If any subscriber desires information as to where he can can obtain a certain type of literary material, we would be glad to print his request regarding it, on the possibility that other technicians would care to provide the information.

Further, if any of the readers would care to submit to us a list of publications and sources of information which might be of interest to others, we could set up a file which would be used for that purpose.

Some colleges and universities have in the past issued publications of interest. For example, we have a pamphlet issued by the State College of Forestry, at Syracuse, New York, in which the identification of pine-needles is described. The booklet is very well illustrated with numerous photomicrographs, supplemented by a detailed identification key. Such a booklet would undoubtedly be of value, from the police standpoint, in certain parts of the country.

The Superintendent of Documents, Washington, D.C., the Forest Products Laboratory, Madison, Wisconsin, and other sources might be mentioned.

Should any of our readers care to submit such information, it is requested that a full and complete description of the source and publication be given, and just how it may be obtained. The name of the contributor will be filed with the material listed.

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Another arrangement which might be of interest would be a similar file on apparatus or equipment, belonging either to individuals or to laboratories, which would be for sale or trade.

In practically every laboratory there are certain pieces of equipment which are no longer used, but which might be of value to another department. If such instruments could be exchanged for others, possibly the trade would be advantageous to both sides. In certain laboratories it would not be legally permissible to sell or trade apparatus. Naturally it would be the responsibility of the laboratory to ascertain that fact before any advertisement was made. In any event, we could handle the preliminary details through "THE TECHNICIAN" provided there was sufficient interest in it. If this is arranged, a file would be made on the material, and items printed in "THE TECHNICIAN". We would expect to be informed as soon as any sale or trade was made in order that the item could be canceled from the file-list.

The editors could not be responsible for any statements made in the advertisements published, nor in the condition of such equipment. It would be the responsibility of the technicians concerned to accurately describe their apparatus.

There would be no charge for the service, which would be available only to subscribers.

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TECHNICAL NOTE

In taking photomicrographs, if it is possible to do so, the lens of any camera used should be removed before the instrument is used. The ocular of the microscope has been designod for use with the objectives supplied. By leaving the camera lens in place, an unnecessary lens system is added to that already in use, and one which can add nothing to the quality of the results obtained. The photomicrograph can not be better than the quality permitted by the poorest lens in the system. A greater number of lenses merely increases the possibility of adding a poor lens, increases the possible internal reflections in the system, and decreases the intensity of the light striking the negative. If the camera lens can not be removed, it should be focused at infinity.

JED

In Acknowledgment:

We wish to thank the editors of the MISSOURI PEACE OFFICERS BULLETIN for the announcement of "THE TECHNICIAN" carried in their April issue, we also appreciate the interest shown in the publication by the editors of the various other bulletins in the police science field.

TECHNICAL NOTE

The terms "depth of focus" and "depth of field", are not synonomous, and one should avoid the use of reference to "depth of focus" when actually discussing depth of field.

"Depth of field" varies directly with the angle formed by light rays entering the camera lens from any one point in the field of view. The smaller the angle formed by these rays, the greater the depth of field,--that is, nearer and farther objects will be in better focus than with a larger angle.

"Depth of focus" refers to the distance over which the negative or ground glass can be moved (with relation to the lens used) before an object no longer appears in satisfactory focus.

This factor varies directly as the angle formed by light rays striking the negative after having passed through the lens.

The shorter the focus of the lens, the larger this latter angle, and the less the depth of focus. (lens diameters being identical)

(The depth of field of two lenses may be identical, yet the depths of focus quite different.)

JED

OF INTEREST:-

THIS PUBLICATION, AS HAS BEEN STATED IN THE INTRODUCTORY COMMENTS, IS DESIGNED IN THE INTEREST OF THE LABORATORY TECHNICIAN-- NOT THE CRIMINAL INVESTIGATOR GENERALLY. WE HAVE RECEIVED A NUMBER OF REQUESTS FROM VARIOUS SOURCES FOR A COPY OF THIS PUBLICATION. SOME OF THESE REQUESTS HAVE OBVIOUSLY COME FROM INDIVIDUALS PRIMARILY INTERESTED IN INVESTIGATIVE METHODS AND PROCEDURES, AND ALTHOUGH THEY WILL BE INTERESTED IN TECHNICAL DATA TO AN EXTENT, WOULD PROBABLY LIKE SOME INFORMATION ON LESS TECHNICAL MATERIAL THAN WOULD ORDINARILY BE INCLUDED HEREIN.

IN ADDITION TO THIS PUBLICATION, PUT OUT BY THE M.S.H.P. LABORATORY, THE DEPARTMENT ISSUES A WEEKLY BULLETIN WHICH IS SENT OUT TO A NUMBER OF LAW ENFORCEMENT AGENCIES. IN THE PAST IT HAS LISTED STOLEN AUTOS, PENITENTIARY RELEASES, ETC. ONLY. BEGINNING WITH THE MAY 7 BULLETIN, AND CONTINUING INDEFINITELY, A SINGLE PAGE WILL BE INCLUDED IN IT ON CRIMINAL INVESTIGATIVE PROCEDURES, HANDLING OF EVIDENCE, CASE REFERENCES, ETC., PREPARED BY THE PERSONNEL OF THE LABORATORY. THIS MATERIAL WILL BE MIMEOGRAPHED. IN THE INTEREST OF OUR SUBSCRIBERS, WE WILL INCLUDE WITH EVERY ISSUE OF "THE TECHNICIAN" A COPY OF EACH OF THESE WEEKLY NOTES. ACCORDINGLY EACH MONTH THERE WILL BE EITHER FOUR OR FIVE PAGES OF ADDITIONAL MATERIAL SENT OUT. MANY OF OUR READERS WILL PROBABLY FIND THAT THESE NOTES ARE ON MATEIRAL WITH WHICH THEY ARE ALREADY QUITE FAMILIAR, AND THAT MAY BE OF LITTLE OR NO VALUE TO THEM. TO OTHERS, HOWEVER, THEY WILL PROVIDE A CONVENIENT AND CONCISE SOURCE OF INTERESTING AND PRACTICAL INFORMATION.

IT IS TO BE UNDERSTOOD THAT THE SUBSCRIPTION FEE TO "THE TECHNICIAN" DOES NOT OBLIGATE US TO FURNISH THESE EXTRA NOTES. THEY WILL BE SUPPLIED, GRATIS, TO EVERY SUBSCRIBER SO LONG AS WE CONTINUE PRINTING THEM. THEY ARE NOT TO BE CONSTRUED AS A PART OF "THE TECHNICIAN", NOR AS NECESSARILY FORMING A SUPPLEMENT TO IT.

THE EDITOR

A number of letters have been received by the editor, in which comments and ideas have been expressed both as to the contents of "The Technician" and the idea behind this publication.

For our convenience we would appreciate it if writers of these letters would, in the future, include a note granting or denying us permission to print such comments in "The Technician", under their names.

Probably some of these letters would be written directly to the authors of material contained in the publication. If so, it is requested that a duplicate copy be sent to the editor in order that the views expressed may be presented to our readers.

A Letter to the Editor:

John E. Davis
Missouri State Highway Patrol Laboratory
Jefferson City, Missouri

My dear Mr. Davis:

I am taking advantage of your invitation to submit comment and criticism on your article "The Identification of Seminal Stains" which appeared in the first issue of The Technician, a copy of which I was very grateful to receive.

No question is made of your tests used for identification purposes. However, the logic underlying your arguments is not within the ethical boundaries enclosing the police laboratory technician. First, the only reliable and accepted test for the identification of seminal stains is the isolation of at least one complete spermatozoa identified as such. As you say, and in complete accord with your statement, it is oftentimes very difficult to identify a sperm cell due to the presence of contaminating material. However, the police laboratory technician is not an ordinary scientist. He is bound by the rules of evidence, by laboratory ethics and by scientific principles, all of which definitely oblige him to an honest and unbiased opinion as to fact. He is not permitted to allow any prejudice which has been formed by police information to enter into his analytical procedure. Many of our present day experts have that failing in common. Through information gained by the police investigation prior to submission of evidence to the laboratory, they have already formed an opinion as to the guilt or innocence of the person under suspicion. In the great majority of cases that pre-formed opinion is a correct one due to the excellency of the police investigation. However, in all honesty and sincerity both to the person charged with the crime and, most of all, to himself, the technician should be guided by his scientific results.

Let us for the sake of discussion present a hypothetical case, one very similar to those handled by the majority of police laboratories.

A man is accused of a sexual crime. Through excellent police investigation he is arrested and gives a statement to the effect that he is the guilty party. In a case of this nature the evidence might consist of the stained underclothing of the victim and perhaps the stained trousers of the defendant. Both of these articles are submitted to the laboratory for the purpose of identification of seminal stains in order to corroborate the defendant's statement. In this instance, perhaps due to contamination or perhaps due to the azoospermatic condition of the defendant, no spermatozoa can be identified in microscopic examination. However, we may have a positive fluorescence test, a positive Florence test, a positive Barberio test and many other tests which may, under those conditions, be positive. In this instance the laboratory technician would have a perfect right to state that the man was guilty by virtue of the police investigation, and not by virtue of his scientific findings. His report should state that he obtained positive results in all of the so-called preliminary tests but was unable to identify spermatozoa. Therefore, he cannot definitely state that it is a seminal stain but there is much indication that it could be a seminal stain. Taking this honest viewpoint, the technician is permitted and should give testimony to that effect. We must remember it is not the function of a police expert to state whether or not a man is guilty. His testimony is simply a description of the condition of the evidence submitted to him and the significance of such condition of evidence. It is, always has been, and always should be the function of the jury to draw conclusions from the testimony of the experts appearing before it.

From a personal viewpoint, the police laboratory technician should remember that he is in a highly specialized field and that his ambitions are the establishment of a career in that highly specialized field. It has been proven by the passage of time that a career built on a foundation of truth and frankness of opinion is much more sturdy than that based upon unscientific methods, prejudiced opinion and perhaps illogical reasoning.

In your discussion of the identification of seminal stains, you omitted one of the most recent advances in such work. That is, the immunological reactions. Several of our fellow workers have presented papers on this subject. However, in discussing this reaction with them their honest opinion has

been that at the present time, it tends to be a reliable test of identification. The difficulties attached to it are chiefly found in the preparation of the precipitin serums. The specificities of the tests have been checked and are found to be worthy. Of course you realize that the principle is based upon the specific antibodies which are present in the body secretions, which fact is taken advantage of in grouping reactions. Prior to the war we were in the act of preparation of the serum. However, since the event of war, conditions in the laboratory have changed considerably so that we have been unable to follow up our anticipated research. However, literature contains many references to it.

Speaking of literature, I heartily recommend to you two very complete works on identifications of seminal fluid stains. (1) Pollak - "Semen and Seminal Stains", which appeared in The Archives of Pathology, Vol 35, No. 1, January 1943, and (2) Weismann's "Spermatozoa and Sterility". Both of these articles contain prolific references to other literature. You will find from an analysis of both of these articles that the only accepted and reliable identification of seminal fluid stains is the isolation of sperm cells.

I wish to point out that the above expressions of comment are purely personal.

I would very much appreciate a response from you containing your comments and criticisms. I am pleased with the invitation to comment on your article and wish to point out that it is purely comment on the subject and not on the author.

Sincerely yours,
