

H. MURAYAMA.
METHOD OF MAKING TRANSPARENT MODELS FOR ANATOMICAL STUDY.
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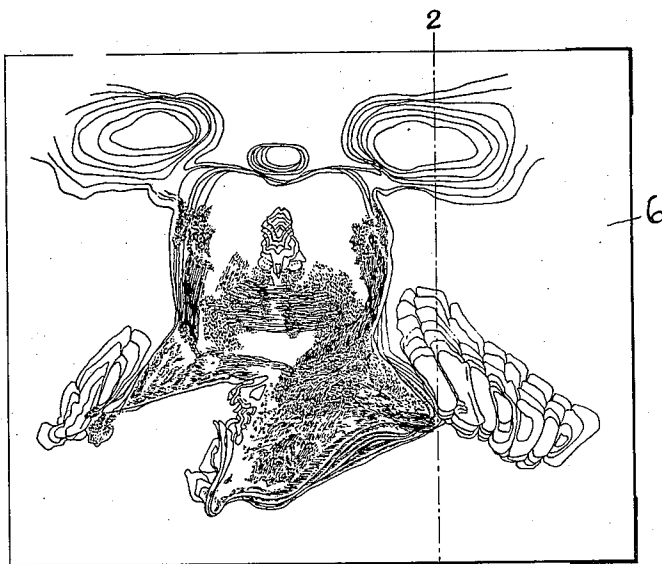
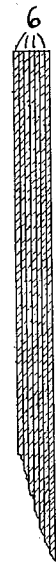
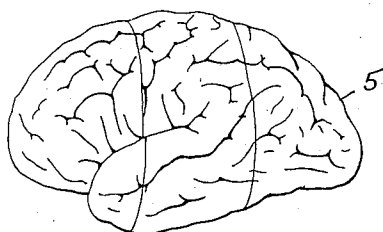
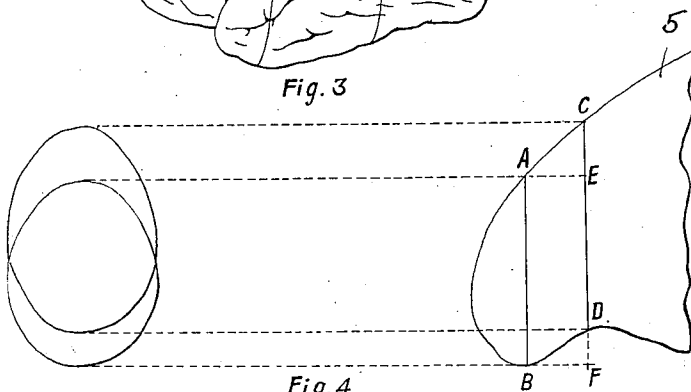


Fig. 1



WITNESSES:

W. A. Darby.
S. E. Darby.

INVENTOR

Hashime Murayama

BY

Samuel Darby
ATTORNEY

UNITED STATES PATENT OFFICE.

HASHIME MURAYAMA, OF NEW YORK, N. Y.

METHOD OF MAKING TRANSPARENT MODELS FOR ANATOMICAL STUDY.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HASHIME MURAYAMA, a subject of the Emperor of Japan, residing in the city, county, and State of New York, have made a certain new and useful Invention in Methods of Making Transparent Models for Anatomical Study, of which the following is a specification.

This invention relates to a method of making transparent models for use in studying anatomical specimens, tissue, cells, or the like.

The object of the invention is to provide a method of making transparent models for the use of students and others in studying anatomical specimens, tissues, cell structures, or the like.

A further object is to provide a method of making models of the nature referred to whereby such models may be produced rapidly and economically.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the mode of procedure hereinafter more fully set forth and finally pointed out in the appended claims.

In the study of anatomy it is common practice to make up specimens of particular parts to be studied by cutting such parts into minute section, that is, in parallel planes of minute distances apart, and suitably mount each section upon a glass or other support for study under the microscope. By reason of the difficulty in securing such sections or specimens, and of studying the same under a microscope the availability thereof for students, or classes or others is very much prescribed. It has been proposed to reproduce specimen sections of the character referred to in enlarged drawings on glass plates and to assemble the plates together, flatwise against each other and in serial order, each having a drawing of a section of specimen taken at a different line or in a different plane from the others, and so related and arranged as to give a perspective outline of the entire organ or part to be studied. The methods heretofore employed in the production of such models have been exceedingly tedious and expensive, requiring special artistic skill to produce each drawing and days of time to complete the same, and by reason thereof they have not come into such general use as their value and importance demand.

It is among the special purposes of my present invention to provide a mode of procedure in the production of models of the character referred to which is simple and efficient, and whereby such models may be produced quickly and inexpensively, thereby placing them easily within the reach of students classes or others desiring to use them in pursuing their anatomical studies.

While my invention is applicable to the study of any desired anatomical specimens of any desired organ or portion of the body, as well as of other objects I will describe it for illustrative purposes, as applied to human brain specimens.

In carrying out my invention I first select the specimens, sectioned and mounted as above explained, and under ordinary circumstances, I have found that it is sufficient, where the organ, tissue, cell or portion concerned is sectioned or divided into, say, one hundred sections, to employ every tenth or twentieth section in making up a model. The important thing is to insure that the enlargements of the drawings shall preserve the same ratio of conformation as the original organ, cell or portion, and consequently the particular serial sections employed may vary according to the requirements, so long as the proper serial relation throughout the entire object is preserved. Each individual specimen section thus selected is then projected, or the enlarged image thereof is projected by any suitable projecting apparatus onto a sheet of specially prepared paper, and the outlines of the projected image of the section specimen, and of its essential parts, is then traced upon the paper in india ink or other material suitable for the production of a drawing directly from which a "negative" or a "negative print" or "negative plate" may be made in the usual way, such for instance, as by the collodion method. In making this outline drawing it is essential to preserve the same degree of enlargement for all the sections composing the entire set employed. Each original section or specimen is then examined under a microscope if necessary and the details thereof filled in on the outline drawing, distinctive colors being employed, if desired, to bring out in the drawing the various tracts, ducts or other desired characteristics of the specimen. I then take plates of transparent material, such for instance, as glass, and reproduce thereon the enlarged drawings from

the negatives above mentioned. The transparent plates should be carefully and specially selected as to the quality and fitness thereof for the purposes in view, and in order to secure the best results in the completed model. Each plate is first treated in the preparation thereof, by applying thereto a solution of the following ingredients and in substantially the proportions stated, namely: calcium carbonate 100 parts, 95% alcohol 250 parts, ammonia 250 parts, water 250 parts. This solution may be applied to the surface of the plate in any suitable manner, such, for instance, as rubbing the same over the surface of the plate. After the application of the solution as above pointed out, I next apply to the surface of the plate a solution of the following ingredients in about the proportions stated, namely: iodine 1 part, 95% alcohol 250 parts. To the surface of each plate, after being treated as above described, I next apply thereto a colloidal or sensitized coating or film. This coating or film may be applied in any suitable or convenient manner, the important thing to be observed being that the coating or film be applied uniformly over the surface of the glass plate, that is the coating or film should be of uniform thickness. I have found that a coating or film composition made up of fish glue or ordinary commercial "Le Page" glue, 80 grams, the whites of two eggs and water 120 cubic centimeters thoroughly mixed together having nine grams of ammonium bichromate dissolved therein will well answer the purpose, but in respect to the exact composition of the colloidal or sensitized material, or the exact proportion of ingredients, my invention is not to be limited or restricted, as other suitable compositions and other proportions might well answer the purpose. After the application of the coating or film as above explained, it is permitted to dry in any suitable or convenient manner, and the plate is then ready to be used in reproduction of the enlarged drawing, above explained, from the "negative plate" produced as described. In carrying out this step of the operation the "negative plate" is superimposed on the sensitized plate and subjected to the action of the actinic light rays, for the required length of time to accomplish the desired results. If the direct sunlight is employed I have found that in the latitude of New York city, for instance, an exposure of from two to five minutes is sufficient. The time of exposure, however, will vary according to latitudes as well as the season of the year. In case an electric arc or other artificial source of actinic light is employed, the length of exposure may be uniform. Of course my invention is not to be limited or restricted in respect to the length of time of exposure.

As a result of the exposure of the "negative plate" upon the sensitized surface of the glass plate a faint impression or image of the drawing becomes visible on the sensitized surface of the glass plate when the negative plate is removed. The glass plate is then immersed in fresh water for a few minutes. This causes the image of the drawing to become set upon the surface of the plate while the coating or film, or that portion thereof which was not affected by the actinic light rays becomes considerably swollen. By slightly agitating the glass plate in the water, or by means of cotton, wool or a camel's hair brush, that portion of the coating which was not affected by the actinic light rays is removed from the surface of the glass plate. This causes the image of the reproduced drawing which, before, was only faintly discernible to become more or less conspicuous owing to the surrounding clean surface of the glass. The glass plate is then dried in any convenient manner and the reproduced image of the enlarged section drawing appearing on the plate is tinted or colored as required or as occasion may call for. This tinting or coloring operation is accomplished in the same manner that the retouching of photographs is carried out. If permanency of coloring is desired a proper mordant is employed. In this case it is preferable to employ coloring material the mordant of which contains alum, chrome-alum, bichromate, or tannin, or like agents which will exert a hardening influence on the image.

It will be readily seen that as many glass plates may be employed with each "negative plate" as may be desired that is, each "negative plate" image may be reproduced on as many glass plates as there are different models to be produced without incurring any more expense than that involved in ordinary photo reproduction or printing and the manipulation of ordinary retouching of photo negatives.

The glass plates having the enlarged reproduced image of the anatomical specimen section produced thereon as above described are now ready to be assembled to form the complete model. The model is made up of as many glass plates each containing a reproduced picture of a different section of the specimen, as may be necessary to include the entire area or volume of the anatomical or other object to be studied, the various plates being placed flatwise upon each other in the required serial order and preserving the proper serial relation. The assembled plates are then bound together in fixed relation to each other in any suitable manner and the model is completed and ready for use, the enlarged reproduced perspective outline of the entire organ to be studied in successive cross sections, being presented to

the eye by holding the model between the observer and the light.

Where, as is usual with most anatomical objects to be studied, as in the case of the human brain, for instance, the object is irregular in surface outline, in order to secure the proper successive or serial relation of the cross sectional drawings in the completed model, it is necessary to properly adjust and fix the position of each glass plate with reference to the "negative plate" so as to conform to the physical exterior contour of the object under investigation at the point where the sectional picture thereof is taken with reference to such contour at the points where other section pictures of the set are taken. To accomplish this the glass plate for the first section of the specimen which I will call drawing No. 1, is produced as above explained. This plate which I will call plate No. 1 is now superimposed upon the drawing or "negative plate" of the next section in order, which I will call drawing No. 2. By means of a photograph of the organ itself and suitable surface measurements obtained therefrom, the required displacement of the image on plate No. 2 with reference to that of plate No. 1, to produce the required successive or serial relation of the images on plates No. 1 and No. 2 in the finished model is easily obtained, and the plate No. 1 so superimposed on drawing No. 2 is correspondingly adjusted with reference to said drawing No. 2. Since all the glass plates are required to be of exactly the same dimensions the proper relative position of adjustment of plate No. 1 on drawing No. 2 is indicated on drawing No. 2 by angle marks at the four corners of said plate No. 1, which marks determine the exact position plate No. 2, should occupy with reference to drawing No. 2, when the image depicted on drawing No. 2 is to be transferred to plate No. 2 after the latter has been treated and coated as above described. Similarly, plate No. 2 is adjusted on drawing No. 3 in order to ascertain and fix the proper position of plate No. 3 when the latter is applied to said drawing No. 3, and so on throughout the entire series.

In the accompanying drawing I have shown a transparent model constructed in accordance with my invention, and have indicated the method employed in producing the same, and wherein—

Figure 1 is a face view of a completed model. Fig. 2 is a transverse section of the same on the line 2, 2, Fig. 1, the superposed plates being broken. Fig. 3 is a view showing a portion of a brain. Fig. 4 is a diagram showing the method of sectioning an anatomical specimen to be studied.

As above described the anatomical specimen, such, for instance, as a portion of the

brain, indicated at 5, is sliced transversely at various points, as indicated by the lines A B, C D, Fig. 3. Ordinarily these slices are made a definite predetermined distance apart, say, for example one one-hundredth of an inch apart, and in making up the model every tenth section is taken for photographic reproduction as above explained, each plate 6 of the completed model carrying an enlarged pictorial reproduction of one of the sections, the completed model built up as described giving a skeleton outline of the entire body of the specimen study.

From the foregoing description it will be seen that I provide an exceedingly simple and inexpensive method of making transparent models for use in the study of anatomical subjects which brings such models within the easy reach of students or other investigators, and that each model is made up of successive serial outline drawings or pictures on transparent plates assembled together in such manner as to present to the eye the entire outline and body of the organ to be studied.

Having now set forth the object and nature of my invention and the method involved, what I claim as new and useful and of my own invention and desire to secure by Letters Patent, is,—

1. The method of making transparent models for use in studying anatomical specimens which consists in tracing on paper the outlines of enlarged views of the specimen, then reproducing photographically the enlarged tracings on transparent plates, and finally assembling the transparent plates in successive serial order to form the completed model.

2. The method which consists in tracing the outlines of successive serial uniformly enlarged sectional views of an anatomical specimen, then photographically reproducing the enlarged tracings on transparent plates, and finally assembling the plates in the successive serial order of the original sectional views to form the completed model.

3. The method which consists in tracing the outlines of successive serial uniformly enlarged sectional views of an anatomical specimen, then supplying the respective enlarged tracings with details of the several specimen sections, then photographically reproducing the enlarged tracings on transparent plates, and finally assembling the plates in the successive serial order of the original sectional views to form the completed model.

4. The method which consists in tracing successive serial uniformly enlarged sectional views of an anatomical specimen, then producing photographic negatives from said tracings, then reproducing photographically

the negative images upon transparent plates and finally assembling said plates in serial order to form the completed model.

5 5. The method which consists in tracing successive serial uniformly enlarged sectional views of an anatomical specimen, then producing photographic negatives from said tracings, then adjusting sensitized transparent plates upon said negatives to conform to
10 the relation of said sectional views, and subjecting the same to the action of actinic light rays, and finally assembling the transparent plates in serial order.

6. The method which consists in tracing
15 successive serial uniformly enlarged sectional views of an anatomical specimen, then producing photographic negatives from said tracings, then photographically reproducing on transparent plates the images from said
20 negatives, and finally assembling said plates in the serial order of said sectional views.

7. The method which consists in tracing successive serial uniformly enlarged sectional views of an anatomical specimen, then
25 applying a sensitized coating to transparent

plates and photographically reproducing said tracings thereon, and finally assembling the transparent plates in the serial order of the original sectional views to form the completed model.

8. The method which consists in tracing
30 serially successive uniformly enlarged sectional views of an anatomical specimen, then applying a sensitized coating to transparent plates and superimposing the same on
35 said tracings and subjecting the same to the action of actinic light rays, then removing the portion of the coating not affected by the light rays, and finally assembling the plates in the serial order of the original
40 sectional views to form the completed model.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 10th day of October A. D., 1913.

HASHIME MURAYAMA.

Witnesses:

S. E. DARBY,

G. A. McGRATH.