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I. MORIOKA

Serial No.

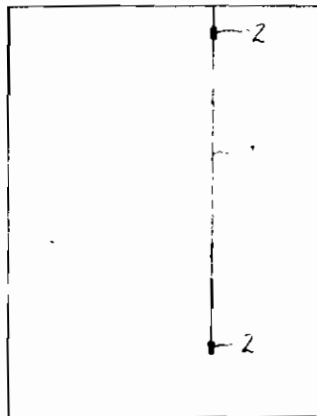
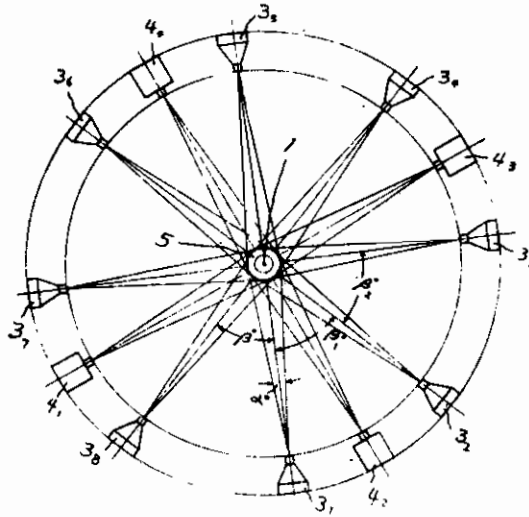
JUNE 15, 1943. PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

366,503

BY A. P. C.

Filed Nov. 20, 1940

2 Sheets-Sheet 1



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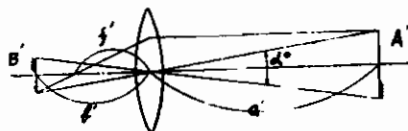
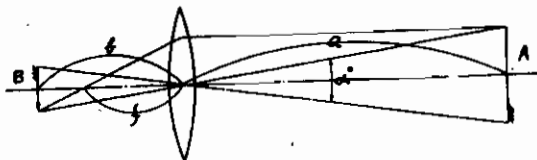
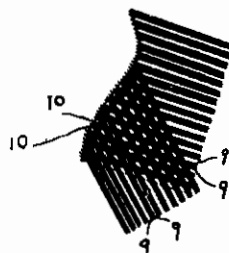
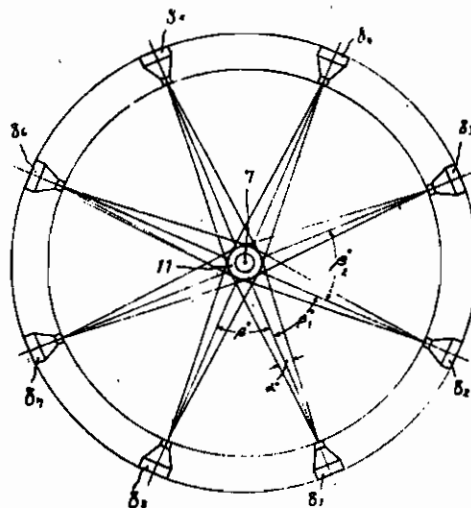
JUNE 15, 1943. PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

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2 Sheets-Sheet 2



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR PLASTICALLY REPRODUCING OBJECTS

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Application filed November 20, 1940

The present invention relates to a process for plastically reproducing objects.

The invention has for its object to sculpture busts or statues all alike to objects to be reproduced.

The process of the invention consists of four steps to be carried out in succession.

The apparatus necessary for the first and second steps consists of a set of more than three cameras and more than two projectors installed around a photographing axis of a vertical slender line indicating an upper and a lower point on itself.

In this case each of said projectors is so arranged as is capable of projecting the image of a screen provided with many stripes or points thereon.

Namely, in the first step, only the photographing axis of said slender line has to be photographed by means of the above mentioned cameras all at a time, and the dry plates thus sensitized, however, have to be left undeveloped.

In the second step, an object to be reproduced, for instance, a human body is caused to sit or stand in the initial position of said photographing axis and a duplicate photographing of the object has to be carried out on the same dry plates undeveloped as those employed in the first step by means of the cameras all at a time by projecting the images of the screens on the object during the whole period of the photographing.

In the third step, the negative photographs treated in the first and second steps have to be enlarged or contracted in the required proportions and printed, so that positive pictures can be obtained.

In the fourth step, a vertical sculpturing axis has to be provided corresponding to the vertical photographing axis which was employed in the first and second steps.

Then the same number of magic lanterns as that of cameras initially employed are installed around said vertical sculpturing axis as a central line in such respectively analogous positions that the cameras initially employed during the photographing in the first and second steps were placed around the vertical photographing axis.

That is to say, each magic lantern, in this case, is so arranged as to take the same projecting angle as that photographing one of each corresponding camera, so that the respective positive picture obtained in the third step can be projected on some plastic material, for instance, modelling clay. And this material has to be heaped, or, as the case may require, milled away up to the

intersecting lines or points of the projected lines of more than two photographs denoting the definite lines or points on the object in accordance with the stripes or points of the screens that were projected on the object in the second step, thereby enabling a bust or statue to be sculptured, very alike to the object to be reproduced.

For better explaining the invention, reference is made to the accompanying drawings.

Fig. 1 is a diagrammatical plan view illustrating the photographing process which has to be carried out in the first and second steps of the present invention.

Fig. 2 is an assumptive view of the negative photograph obtained in the second step.

Fig. 3 is a negative photograph obtained in the first and second steps.

Fig. 4 is a diagrammatical plan view illustrating the arrangement of magic lanterns for the purpose of projecting the positive picture in the third step, in which the negative photograph produced in the second step has to be tightly stuck or enlarged and printed.

Fig. 5 is a partial view indicating the fourth step.

Fig. 6 is a diagrammatical view illustrating the enlarging or contracting proportions of a taken picture and also indicating the process for determining the distance between the magic lanterns and the plastic material to be sculptured.

Two points, 2, as shown in Fig. 2 are indicated respectively at an upper and a lower position on the vertical photographing axis 1 consisting of a slender line as shown in Fig. 1.

More than three cameras 3 and more than two projectors 4 are installed around said axial line 1, all of them confronting it.

In this case, the shutters of the cameras 3 are so arranged as to be opened or closed all at one time.

The above-mentioned projectors 4 are provided with screens inside, on which many stripes or points are dispersed so that the images of these screens can be illuminated and projected on the object to be reproduced.

By employing a set of said cameras and projectors, the photographing process must be carried out during the first and second steps.

In order to effect the invention, the following four steps have to be carried out in succession.

In the first step:

The electric lamps of the chamber have to be put out so that only the slender line indicating the axis 1 can be illuminated by means of the projectors and photographed by means of the

cameras all at a time, however, leaving the dry plates undeveloped. (Fig. 2 shows a developed one of the photographs.)

Numeral 1 in Fig. 1 is a slender line indicating the photographing axis. Numeral 2 represents two points signalized on the slender line.

In the second step:

The above mentioned slender line 1 must be removed first, and the object 5, for instance, a human body is caused to take the initial place of said line 1, so that the images of the screens are projected on the object by means of the projectors 4 all the time, during which the shutters of the cameras 3 have to be opened all at a time, thus carrying out a duplicate photographing of the object on the same dry plates as those employed in the first step and now developing them.

Fig. 3 shows a negative photograph obtained in the first and second steps.

Numeral 1, in the drawing, represents the photographing axis, 2 two points signalized on the slender line, 5 a photograph of the object, and 6 a picture of the images of the screens.

In the third step:

The picture thus obtained in the second step is enlarged or contracted in the required proportions and printed in accordance with the focal distance of the lenses of the cameras, the size of a bust or statue to be sculptured and the focal distance of the lenses attached to magic lanterns which will be employed in the following fourth step.

If the size of the object 5 is assumed to be A, the size of a bust or statue to be sculptured A', and the focal length of the lenses of the cameras and magic lanterns to be f and f' respectively, the required proportions can be determined by the following equations, as the photographing angle and the projecting one of magic lantern comes to the same degree α°, which has been promised according to the invention. (Refer to Fig. 6.)

1/f = 1/a + 1/b ----- (1)

1/f' = 1/a' + 1/b' ----- (2)

A/A' = a/a' = K (constant) ----- (3)

From the first, second and third equations,

b/b' * (a-f'K)

In the fourth step:

There must be now provided a sculpturing axis 7 in a vertical direction, corresponding to the photographing axis consisting of a slender line as employed in the first and second steps.

The same number of magic lanterns 8 as that of cameras already employed in the first and second steps must be installed around said sculpturing axis 7 exactly in such analogous positions that the cameras 3 were around their axial line 1.

And each magic lantern is so arranged as to take the same projecting angle α° as that photographing one (α°) of each corresponding camera already employed, thereby enabling the positive photograph obtained in the third step to be projected on.

Whether the position of each magic lantern 8 to the sculpturing axis 7 is exactly analogous to that of each camera to the photographing axis, as mentioned above, can be judged by examining

whether the image of the photographing axis 1 and the projected images of the upper and lower points 2 on the positive photograph which is being projected by each magic lantern 8 have fallen exactly on the sculpturing axis 7, or also by examining whether each neighbouring camera may correspond each angle, for instance, β°, β1° or β2°, as the axis 1 for a common vertex, to each other respectively.

In order to correspond the projecting angle α° of magic lantern to the photographing one α° of camera, the positive photograph enlarged or contracted in the required proportions in the third step will have only to be treated in such a manner that the distance between the sculpturing axis 7 and the optical centre of the lens of a magic lantern is made constant α' by employing said lantern having a constant focal length f' as shown in Fig. 6.

According to the fourth step, a set of magic lanterns, as mentioned above, are employed, and clay or other plastic mass 11 is placed after the sculpturing axis 7 has been removed.

Then two neighbouring magic lanterns 81 and 82 or other two lanterns 81 and 83 forming a larger angle, as the axial line 7 for its vertex, may be employed so that the illuminated lines of the positive photographs obtained in the third step can be projected on the plastic mass through said lanterns. And the mass may be heaped or milled away up to the intersecting position 10 of the projected lines or points 9 and 9' corresponding to each other among all of the lines or points which were the illuminated images of the screens on the object, thus sculpturing the whole circumference of the bust or statue.

In the case of projecting the positive pictures at the same time through two magic lanterns, as mentioned above, it is better to use two transparent screens, different from each other in colour, for instance, a red-coloured cellophane is attached to the one magic lantern and a blue-coloured one to the other so that the intersecting point 1 of both projecting lines can be easily found out, thereby facilitating an easy discovery of any errors on the bust or statue to be made during the sculpturing operation.

According to the present invention, more than two of upper and lower signalized points 2 are photographed in the first step, so that the photographs thus taken serve as preparatory means for making the position of magic lantern to the sculpturing axis 7 to be employed in the fourth step analogous to that of camera 3 to the photographing axis initially employed in the first and second steps.

In the second step of photographing the object 5, a duplicate photographing of it is carried out on the same dry plates of the axial line 1 obtained in the first step, and the relative position of both is recorded, and the screens are also projected on the object so that the discovering of the intersecting point 10 of the projected lines of the definite points photographed on the object can be readily facilitated.

In third step, the photographs taken in the first and second steps are enlarged or contracted in the required proportions, which is determined on a definite basis of calculation, thus serving to equalize the photographing and projecting angles later on, and which conditions are indispensable for making the bust to be sculptured in the fourth step quite analogous to the object to be reproduced.

In the fourth step, by utilizing all the condi-

tions which have been prepared in from the first to the third step, firstly, the same number of magic lanterns 8 as that of cameras initially employed are installed around the sculpturing axis 7 in such analogous positions that the cameras were placed around the photographing axis 1 with the signalized points 2 provided thereon.

Secondly, the projecting angle α° through magic lantern is made entirely equal to the photographing one α° in the case of the first and second steps.

Thirdly, it is readily facilitated to discover the intersecting point 10 of the projected lines illuminating the photographs containing the definite points on the object by projecting the photo-

graphs of the projected images of the screens with many stripes or points provided thereon, which were employed in the first and second steps, thereby securing the precise degree of analogical property between the object and the bust or statue to be sculptured, and moreover, enabling it to be made readily.

Namely, according to the present invention, all the steps from first to fourth, stand in close relation to one another and the analogous property of the bust or statue to the object has been guaranteed just by carrying out the afore-said four steps one by one in succession.

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