L. B. MANHEIMER.

RELIEF MAP AND PROCESS OF MAKING SAME.

APPLICATION FILED AUG. 2, 1919.

1,351,392. **Patented Aug. 31, 1920.**

2 SHEETS—SHEET 1.

Fig. 1

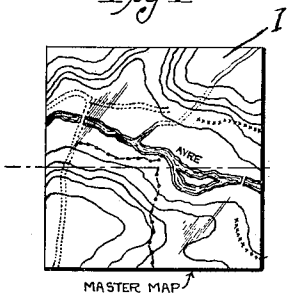


Fig. 2

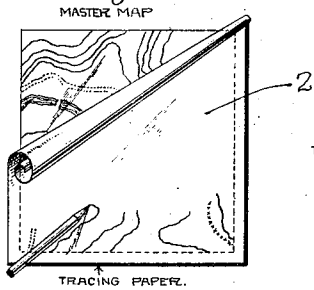


Fig. 3

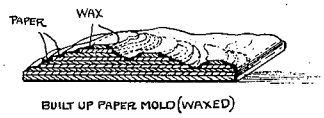


Fig. 4

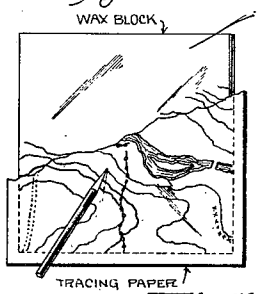


Fig. 5

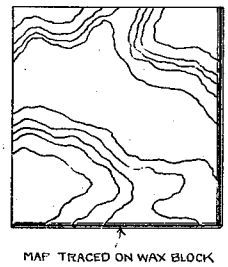


Fig. 6

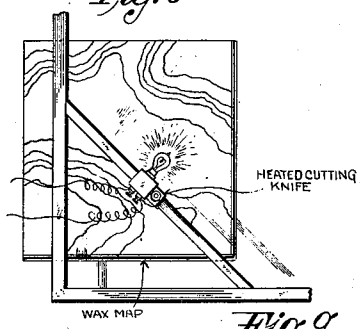


Fig. 7

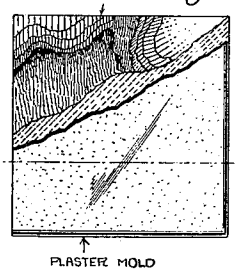


Fig. 8

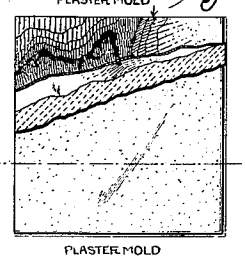


Fig. 9

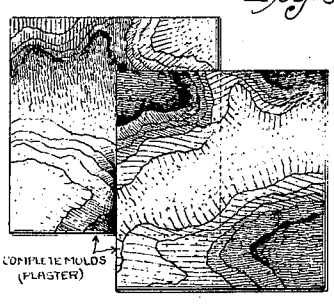
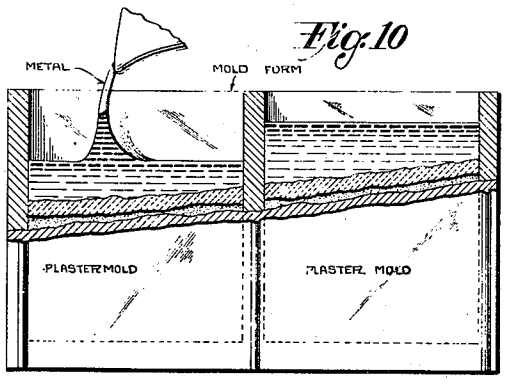


Fig. 10



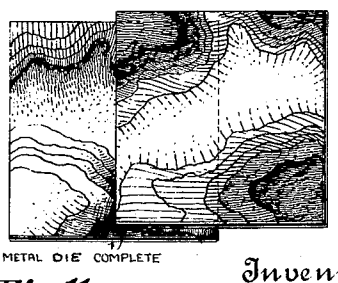


Fig. 11

Inventor

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2 SHEETS—SHEET 2.

Fig. 12



Fig. 13

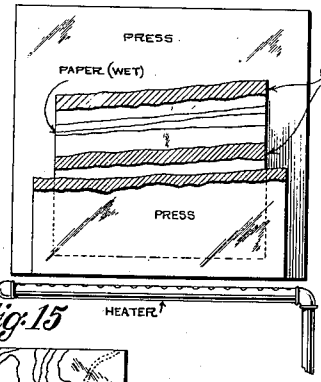


Fig. 14

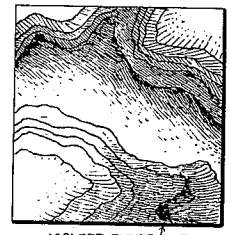


Fig. 15

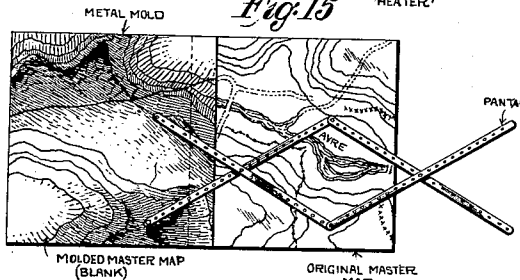


Fig. 16

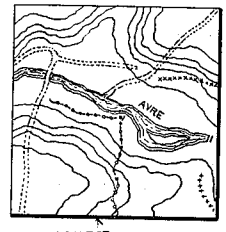


Fig. 17

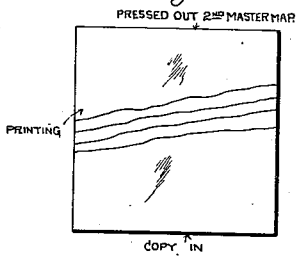


Fig. 18

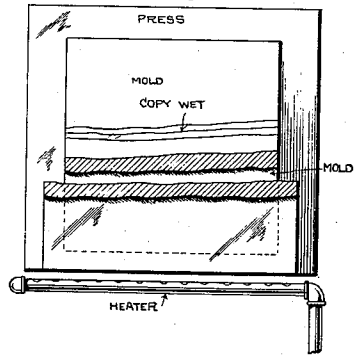


Fig. 19

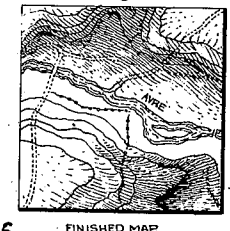


Fig. 20

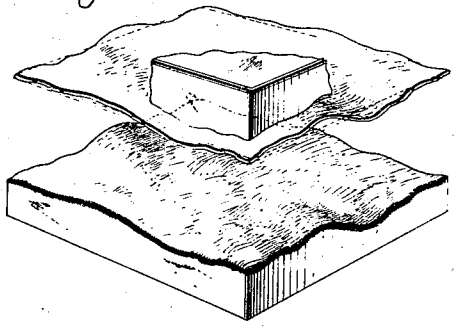
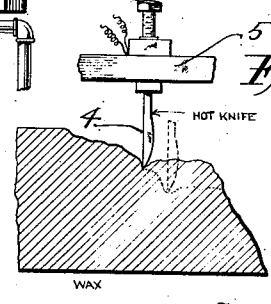


Fig. 21



Inventor

Louis B. Manheimer

UNITED STATES PATENT OFFICE.

LOUIS B. MANHEIMER, OF LONG ISLAND CITY, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-THIRD TO SAID LOUIS B. MANHEIMER, ONE-THIRD TO FLEMING NEWBOLD, AND ONE-THIRD TO FRANK T. FULLER, BOTH OF WASHINGTON, DISTRICT OF COLUMBIA.

RELIEF-MAP AND PROCESS OF MAKING SAME.

1,351,392. Specification of Letters Patent. Patented Aug. 31, 1920.

Application filed August 2, 1919. Serial No. 315,013.

To all whom it may concern:

Be it known that I, LOUIS B. MANHEIMER, a citizen of the United States, and a resident of Long Island City, New York, have invented new and useful Improvements in Relief-Maps and Processes of Making Same, of which the following is a specification.

This invention relates to new and useful improvements in maps and more particularly to the method or process of producing, singly or in quantity, maps which conform to the contour of the terrain. However, the invention, both as to process and products, is also applicable to illustrations other than maps.

The objects of this invention are to provide a novel form of relief map and also to provide a method or process of reproducing singly or in quantity from the ordinary flat map, relief maps which conform not only to the actual contour of the terrain represented on the flat map, but which will also show on a true or exaggerated scale the natural and artificial features of the terrain, such as streams, roads, forests and the like.

The methods of producing relief maps heretofore employed have usually consisted in building the model from a number of flat slabs, or in carving out or otherwise modeling a map from a plaster composition, wax, or other similar material. From these models it has been possible to form molds upon which may be transferred the features of the flat map which it is desired to reproduce.

It is well known, however, that the method of producing relief maps as outlined above requires considerable labor as each map must be drawn or printed upon the model which is ultimately to be used. A heavy and bulky map which is difficult to transport on account of the size and weight and one that is easily broken or cracked is the result of the methods formerly used. Furthermore, when it is necessary to have a considerable number of relief maps showing the same terrain, as is often desirable in military operations the usual methods of forming relief maps have been found unsatisfactory on account of the time involved in making such maps as each copy had to be drawn or printed separately by hand after the relief work had been formed on the model.

By this invention a method is provided of reproducing from a single model any desired number of relief maps which conform to the actual contour of the terrain and which correctly present the features thereof. A novel method is also provided of forming a model which shows in relief the natural and artificial features of a given flat map.

In the accompanying drawings, Figure 1 is a plan view of a master map with the contour lines;

Fig. 2 is a similar view of a master map with tracing paper superimposed;

Fig. 3 is a perspective view partly in section of a built up model;

Fig. 4 is a plan view with tracing paper positioned for producing indentations in wax block, a portion of the tracing paper being shown removed;

Fig. 5 is a plan view of the wax block previous to carving;

Fig. 6 is a similar view of the wax block with implement employed for carving;

Fig. 7 is a plan view of the plaster positioned upon the wax model for producing the plaster mold;

Fig. 8 is a plan view of the plaster counter mold formed from the plaster mold;

Fig. 9 is a similar view of the completed mold and counter mold;

Fig. 10 is a side elevation partly in section illustrating the metal casting box;

Fig. 11 is a plan view of the metal die and counter die;

Fig. 12 is a plan view of the map, two of the sheets being partly removed;

Fig. 13 is a plan view of metal dies with matrix illustrating relative position of mold and matrix between press boards, the metal mold and counter mold and one of the press boards being shown in section;

Fig. 14 is a similar view of the molded paper map;

Fig. 15 is a plan view illustrating one of the means for transferring the contour

lines from the original master map to the molded map;

Fig. 16 is a similar view of the pressed, distorted master map;

Fig. 17 is a similar view of a second master map;

Fig. 18 is a plan view of the metal dies with a matrix illustrating relative position of the mold with matrix between the press boards during the process of restoring the map to its desired form, the metal mold and one of the press boards being shown in section.

Fig. 19 is a plan view of the finished map;

Fig. 20 is an enlarged perspective view of the map and metal mold and counter mold;

Fig. 21 is a side elevation of the preferred form of knife employed in carving the wax, the wax model being shown in section.

Referring to the drawings, 1 designates the master map from which it is desired to reproduce a relief map.

The master map is in the form of a flat topographic map upon which are drawn the contour and other natural and artificial features of the terrain represented. It is, of course, to be understood that any form of map presenting the topographic features of a terrain may be used.

A sheet of tracing paper designated 2 is placed over the master map upon which is transferred the contour and other markings on the master map which relate to the configuration of the terrain. A block of wax 3, or other similar material having a relatively low melting point, and which is substantially of the same area as the master map is used. The thickness of the block is determined by the vertical scale of the relief map that is to be produced. In actual use it has been found that the vertical scale most desirable is equal to five or ten times the horizontal scale and the thickness of the wax block is determined by the distance between the highest and lowest point shown on the master map, measured according to the vertical scale. The tracing paper 2 having the contours of the master map drawn thereon is then placed upon the wax block in relatively the same position as placed on the master map. The contour lines are then transferred to the wax block by tracing over these lines with a sharp pointed instrument. The tracing paper is then removed from the wax block, which then appears as shown in Fig. 5.

The next step is to form a model of the wax block by carving each contour to its true depth and removing the wax between the consecutive contours or by building up the contours by slabs of wax or card-board of the thickness of a contour and sloping the consecutive slabs to form a true surface or a combination of these methods. The carving is done by means of any suitable cutting tool, but it will be readily understood that in forming a model of a large map the performance of all the operations by hand alone will consume considerable time. By my invention I provide a novel form of cutting tool, which is shown in its simplest form in Fig. 21.

Referring to Fig. 21, the tool comprises an electrically heated knife or needle 4 that is supported on a frame 5 preferably mounted on rollers, or is provided with any other suitable means by which it may be moved from place to place. The tool is vertically adjustable with respect to the frame 5 by means of a screw adjustment designated 6. In using this apparatus in the production of a relief map, the tool is first set at a height corresponding with the highest contours as determined by the vertical scale. The tool is then electrically heated and its point run around the trace of the highest contour as it appears in Fig. 5. All of the wax outside of the cut made by the tool is then removed to a depth equal to that of the cut by means of suitable scraping tools as above referred to. The tool is then set at the height of the next lower contour and another cut made as shown in dotted lines in Fig. 21, after which the wax is removed as before. This procedure is followed until the lowest contour has been reached after which the wax remaining between the contour cuts is carved away to conform to the configuration between the contours so that a smooth model of the master map is thus produced. It is of course to be understood that the means employed in obtaining the wax model is not limited to the process described, as a building up process as shown in Fig. 3 is at times expedient.

The completed wax model is then placed in a suitable form and a plaster mold is made therefrom as shown in Fig. 7. The surface of the mold is then treated with shellac, varnish or other similar material to render it impervious to water after which a plaster counter mold is made therefrom as shown in Fig. 8 which is an exact reproduction of the original wax model. The mold and counter mold are then placed separately in a suitable metal casting box, as shown in Fig. 10 and molten metal, such as the casting metal employed in linotype machines, is poured into the casting box. When pouring the molten metal, the mold and counter mold are preferably placed on edge and sufficient metal is poured in to cover the tops of the plaster molds. When the metal has cooled, the plaster molds together with the die and counter die are removed from the box after which the dies

are cleaned and all excess metal removed. Completed metal mold is shown in Fig. 11. The metallic counter-mold may be made by electrolytic deposition.

A paper matrix is then formed by pasting together several sheets of paper and thin blotting papers as in Fig. 12. The material of the matrix forms no part of my invention and it is to be understood that any kind of matrix material commonly employed by printers may be used.

While the paste in the matrix is still wet, it is placed upon the metal die and a sheet or sheets of soft cloth is placed on the top thereof. The metal counter die is then placed upon the cloth and the dies together with the matrix are placed in a steam press as shown in Fig. 13 and subjected to a pressure of approximately 120 pounds per square inch for a period from five to ten minutes. The form of press forms no part of this invention and as it is shown diagrammatically in Fig. 13 it is to be understood that any form of steam press commonly employed in printing establishments may be used.

The press is then opened and the matrix is removed from between the dies. The matrix then appears as shown in Fig. 14. It is then hard and stiff and is found to conform exactly to the metal die and the original wax model. The matrix so formed is a new product of this invention. It has been found that two or even three matrices may be molded at the same time.

When the matrix is thoroughly dry it is placed upon the metal die and the original master map is placed beside it as shown in Fig. 15. All of the lines and markings which appear on the master map are then transferred to the molded matrix by means of a pantograph in which the pointer passes over the master map, the marker making the desired mark on the surface of the mold. The marker of the pantograph is adapted to move vertically up and down as it passes over the matrix so that a true map is traced upon the matrix. Any writing or other descriptive matter is then drawn upon the matrix and four or more marks for indicating the position of the matrix with respect to the die are then made. Such matrix with the illustration applied to its surface is itself a new product of this invention. The transfer may also be made from the master map by photo projection upon the matrix which has previously been sensitized. This is in itself a novel method of reproducing one color relief map in quantity at a considerable saving of time and labor.

The matrix is then removed from the die and after being moistened is pressed out upon a flat surface and allowed to dry. The flattened matrix then appears as shown in Fig. 16 and it will be noted that the features of the map are then distorted as compared with the features of the master map so that it no longer presents a true map. Such flattened distorted illustration is a new product of this invention. The flat distorted map on the matrix is then transferred or reproduced by any of the well known photolithographic processes to produce any desired number of copies of the distorted map, and such copies constitute a new product of this invention.

These copies are then respectively mounted upon several sheets of backing material, similar to that employed in making up the original matrix and while the paste is still wet the copy matrices are placed on the metal die. The metal die and counter die, with the matrix between, is then placed in the steam press, Fig. 18 as previously described, and the finished copies of the original matrix with all the features of the master map printed thereon is produced. Such finished copies are a new product of this invention.

A finished copy of relief map formed in accordance with this invention is shown in Fig. 19 and it is obvious from the foregoing that any desired number of such copies may be formed. A relief map so formed is very light in weight and at the same time possesses a high degree of stiffness, so that it is suitable for use in military operations in the field. Furthermore, such a map shows not only the true form of the terrain covered by the master map, but also presents on a true or exaggerated scale, if desired, all of the natural and artificial features of the terrain.

While the method of procedure has been described in its simplest and preferred forms, it is susceptible of various other modifications within the scope of the invention. Furthermore, although the process and the several new products resulting at different stages thereof, have been described with particular reference to maps, the invention applies to illustrations and figures with undulating or uneven surfaces, other than maps, which are to be understood as embraced by the term "map" as employed in the claims.

The term "projecting" as employed in the claims applies to methods of reproducing one illustration from another, such as by pantography, photography, or by reducing an illustrated undulating surface to a flattened condition, and vice versa, in which methods the accuracy of correspondence of the resulting "projection" to the original illustration is mechanically determined from the latter,—as contradistinguished from methods in which the accuracy of correspondence is dependent upon human skill even when assisted by methods of plotting or guide lines.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A process of making relief maps, consisting of forming a model of a relief map by carving out and building up, forming a metallic die and counter die of the model, molding a matrix to the form of the relief map, transferring to the matrix the written and drawn features of the map which is being copied, flattening the matrix, reproducing the flattened matrix, and molding the reproduction to the relief form.

2. A process of making relief maps, consisting of forming a model of a relief map, preparing a metallic die and counter die of the model, molding a matrix to the form of the relief map, transferring to the matrix the written and drawn features of the map which is being copied, pressing the matrix flat, reproducing the flattened matrix, and molding the reproduction to the relief form.

3. A process of making relief maps, consisting of forming a model of a relief map, preparing a metallic die and counter die of the model, molding a matrix to the form of the relief map, transferring the written and drawn features of the map which is being copied to the matrix by means of a pantograph, flattening the matrix, reproducing the flattened matrix, and molding the reproduction to the relief form.

4. A process of making relief maps, consisting of carving out a model of a relief map, preparing a metallic die and counter die of the model, molding a matrix to the form of the relief map, transferring to the matrix the written and drawn features of the map which is being copied, flattening the matrix, reproducing the flattened matrix by photolithography, and molding the reproduction to the relief form.

5. A process of making relief maps, consisting of forming a model of a relief map, preparing a metal die and counter die of the model, forming a blank matrix from said dies, photographically projecting upon the matrix the written and drawn features of the map which is being copied.

6. A process of making relief maps, consisting of carving out a model of a relief map, preparing a plaster mold from the model, preparing a metallic die and counter die from the plaster mold, forming a matrix from said dies, transferring to the matrix the written and drawn features of the map which is being copied, flattening the matrix, reproducing the flattened matrix and molding the reproduction to the relief form.

7. The process of making maps or other illustrations upon undulating surfaces, consisting of forming a model of the undulating surface, making a mold of the model, molding a matrix from said mold, sensitizing the surface of said matrix, and projecting the illustration which is being copied upon said sensitized surface of the matrix by photography.

8. A process of making relief maps, consisting of building up a model of a relief map, preparing a die and counter die of the model, molding a matrix to the form of the relief map, sensitizing the matrix, and reproducing on the sensitized matrix by photography the written and drawn features of the map which is being copied.

9. A process of making relief maps, consisting of building up a model of a relief map, preparing a plaster model of the model, casting a metallic die of the plaster model, preparing a metallic counter die of the plaster model by electrolytic deposition, molding a matrix to the form of the map, transferring to the molded matrix the written and drawn features of the map which is being copied, flattening the matrix, reproducing the flattened matrix, and molding the reproduction to the relief form.

10. A process of making relief maps or other illustrations, consisting of forming a model of a relief map, forming a die of the model, molding a matrix from the die, applying to the matrix the illustration of the map which is being copied, flattening the matrix, reproducing upon a suitable material the illustration of the flattened matrix, and molding the reproduction to the relief form.

11. A process of making relief maps, consisting of forming a model of a relief map, preparing a die of the model, molding a matrix from said die to the form of the relief map, applying to the matrix the illustration of the map which is being copied, flattening the matrix, reproducing the illustration of the flattened matrix by photolithography, and molding the reproduction to the relief form.

12. A process of making relief maps, consisting of forming a model of a relief map, preparing a die of the model, forming a matrix from the die and photographically projecting upon the matrix the illustrative features of the map which is being copied.

13. The process of producing relief maps consisting in making a flattened distorted reproduction of a relief map by a procedure including reproduction of illustrative matter of the illustration upon a corresponding relief surface and flattening said surface, and then conforming said reproduction to variations of surface illustrated thereby.

14. The process of producing illustrations upon undulating surfaces, consisting in making a flattened distorted reproduction of an illustration by a procedure including reproduction of illustrative matter of the illustration upon a corresponding undulat-

ing surface and flattening of said undulating illustrated surface, and then conforming said reproduction to variations of surface illustrated thereby.

15. The process of producing illustrations upon undulating surfaces, consisting in first making an undulating surface bearing its corresponding illustration, producing therefrom a flattened distortion of the illustration, making a reproduction of the latter, and then shaping said reproduction to properly undulate its illustrated surface.

16. The process consisting in producing an illustration upon an undulating surface, transforming the same to a flattened condition and thereby distorting the illustration, and then making a reproduction of said flattened distorted illustration.

17. The process consisting in producing an illustration upon an undulating surface, transforming the same to a flattened condition and thereby distorting the illustration, reproducing said flattened distorted illustration, and then shaping said reproduction to properly undulate its illustrated surface.

18. The process of producing maps or other illustrations with undulating or varying surfaces, consisting in producing the illustration on the desired undulating surface, flattening the same and thereby distorting the features of illustration, and molding said distorted map or illustration to conform to said undulations or variations of surface.

19. The process of producing a map or other illustration having an undulating surface, consisting in forming a die conforming to the surface undulations of a map or illustration, producing the illustration upon an undulating surface, making from the latter a flattened illustration with the features thereof distorted, then subjecting said distorted illustration to the action of said die to produce an undulating surface illustration having its features in proper relationship to its undulations of surface.

20. The process of quantitative production of relief maps or other illustrations upon undulating surfaces, consisting in making distorted reproductions upon paper or paper-like material, then shaping said reproductions to produce undulations of surface in accordance with the map or illustration.

21. The process of quantitative production of relief maps or other illustrations upon undulating surfaces, consisting in making distorted reproductions upon paper or paper-like material, then molding said reproductions to produce undulations of surface in accordance with the map or illustration.

22. A map or other illustration having an undulatory illustrated surface formed by molding paper or paper-like material to the surface of which the illustration has been applied in distorted form before molding.

23. A map or other illustration having an undulatory illustrated surface formed by molding a suitable material to the surface of which the illustration has been applied before molding with the features of illustration thereof in distorted projection in conformity with the surface undulations to be imparted by the molding.

24. A relief map produced by molding into relief form a flattened surface bearing in distorted projection an illustration of a map.

25. A flattened distorted projection of a relief map adapted when shaped into relief to present an approximately true illustration of the map.

26. A reproduction made from a distorted representation of an illustration, said distorted representation having been produced by flattening an uneven surface bearing and conforming to the illustration.

27. The process of producing relief maps or other illustrations upon undulating surfaces, consisting in making distorted reproductions upon substantially non-elastic material, then shaping said reproductions to produce undulations of surface in accordance with the map or illustration.

28. A map or other illustration having an undulatory illustrated surface formed by molding substantially non-elastic material to the surface of which the illustration has been applied in distorted form before molding.

29. A copy upon suitable material of a distorted illustration produced by flattening an undulating surface bearing the illustration.

30. A facsimile reproduction upon suitable material of illustrative matter appearing upon a distorted illustration produced by flattening an undulating surface bearing the illustration.

31. A map or other illustration having an undulatory illustrated surface with the undulations of surface corresponding to the illustration thereon and produced by photographing the illustrative matter upon said undulatory surface in proper relationship therewith.

32. A map or other illustration having an undulatory illustrated surface bearing informative matter with the undulations of surface corresponding to the informative matter thereon and produced by photographing the informative matter upon said undulatory surface in proper relationship therewith.

33. A flattened distorted illustration produced by flattening an undulating surface upon which the illustrative matter has been photographed.

34. The process of making relief maps or other undulating surface illustrations which comprises, producing a distorted projection of the matter to appear on the completed relief map, and forming said projection into the shape of the surface variations represented thereby.

35. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, making a distorted projection of said relief map, and forming a relief map from the distorted projection.

36. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, applying informative matter to its surface, making a distorted projection of said relief map with said matter thereon, and forming a relief map from said distorted projection.

37. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, making a distorted projection of said relief map, duplicating said distorted projection, and forming the duplicate copies into relief maps.

38. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, applying informative matter to its surface, making a distorted projection of said relief map with said matter thereon, duplicating said distorted projection, and forming the duplicate copies into relief maps.

39. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, flattening said map to form a distorted projection thereof, duplicating said distorted projection, and forming said duplicate copies into relief maps.

40. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, applying informative matter to its surface, flattening said map to form a distorted projection of said map and the matter thereon, duplicating said distorted projection, and forming the duplicate copies into relief maps.

41. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map, forming a distorted projection of said map in relatively inelastic material, duplicating said distorted projection, and molding the duplicate copies into relief maps.

42. The process of making relief maps or other undulating surface illustrations with the undulations of surface corresponding to the illustration thereon, which comprises molding a copy of the undulating surface in relatively inelastic material, applying illustrative matter to said molded copy in proper relationship to its undulations of surface, and making duplicates from said last-named copy including the illustrative matter.

43. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map in the form of a die, molding a copy of the relief map therefrom in relatively inelastic material, forming a distorted projection of said copy, and making duplicate copies of said projection.

44. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map with informative matter thereon, forming a distorted projection of said map in relatively inelastic material, duplicating said distorted projection, and molding the duplicate copies into relief maps.

45. The process of making relief maps or other undulating surface illustrations bearing informative matter with the undulations of surface corresponding to the informative matter thereon, which comprises molding a copy of the undulating surface in relatively inelastic material, applying informative matter to said molded copy in proper relationship to its undulations of surface, and making duplicates from said last-named copy including the informative matter.

46. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map in the form of a die, molding a copy of the relief map therefrom in relatively inelastic material, applying informative matter to said molded copy, forming a distorted projection of said copy, and duplicating said last-named copy.

47. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map in the form of a die, forming in relatively inelastic material a distorted projection of the relief map with informative matter thereon, and duplicating said last-named copy.

48. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map in the form of a die, molding a copy from said die, forming a distorted projection of said map, and forming the distorted projection into a relief map.

49. The process of making relief maps or other undulating surface illustrations which comprises, making a relief map in the form of a die, forming in relatively inelastic material a distorted projection of said die, and forming said distorted projection into a relief map.

50. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, pressing said map into a flat surface, duplicating the

flattened map, and pressing the duplicate copies into relief maps.

51. The process of making relief maps or other undulating surface illustrations which comprises, forming a relief map, applying informative matter to its surface, pressing said map into a flat surface, duplicating the flattened map, and pressing the duplicate copies into relief maps.

52. A flat map having its geographical features so determined by projection that when said map is formed into topographical relief its geographical features are not displaced out of their approximately true position.

53. A flat illustration having its features so determined by projection that when said illustration is formed into corresponding undulating surface its features will be disposed in approximately true position relative to the surface undulations.

54. A flat map or illustration formed by pressing an undulating surface map or illustration into a flat surface.

55. A flat map having its geographical features so positioned by projection that when pressed into a relief map they will assume their true geographical position.

56. A flat map bearing informative matter so distorted by projection that when said map is pressed into a relief map said matter will assume its proper form.

57. A flat map formed by pressing a relief map having informative matter thereon into a flat surface.

58. A flat map having its descriptive and illustrative matter and topographical features so distorted by projection that when pressed into a relief map said matter and features will assume their proper form and relation.

59. A relief map formed from a flat map having its topographical and informative features distorted by projection in proportion to the extent of displacement necessary to form said relief map.

60. A flat map having all its features distorted by projection in proportion to the displacement necessary to form a relief map therefrom.

61. A flat map having its descriptive and illustrative matter distorted by projection in proportion to the displacement necessary to obtain its proper form when pressed into a relief map.

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