VOLUME I NUMBER 7

NOVEMBER, 1914

THE MINERAL RESOURCES OF OREGON

Published Monthly By

The Oregon Bureau of Mines and Geology

The Relief Map of Oregon

Construction and Use of the Relief Map

By S. SHEDD

Tests of Building Brick, Hollow Blocks, and Drain Tile

By IRA A. WILLIAMS

Limestone Deposits in Oregon

By IRA A. WILLIAMS

Entered as second class matter at Corvallis, Ore. on Feb. 10, 1914, according to the Act of Aug. 24, 1912.

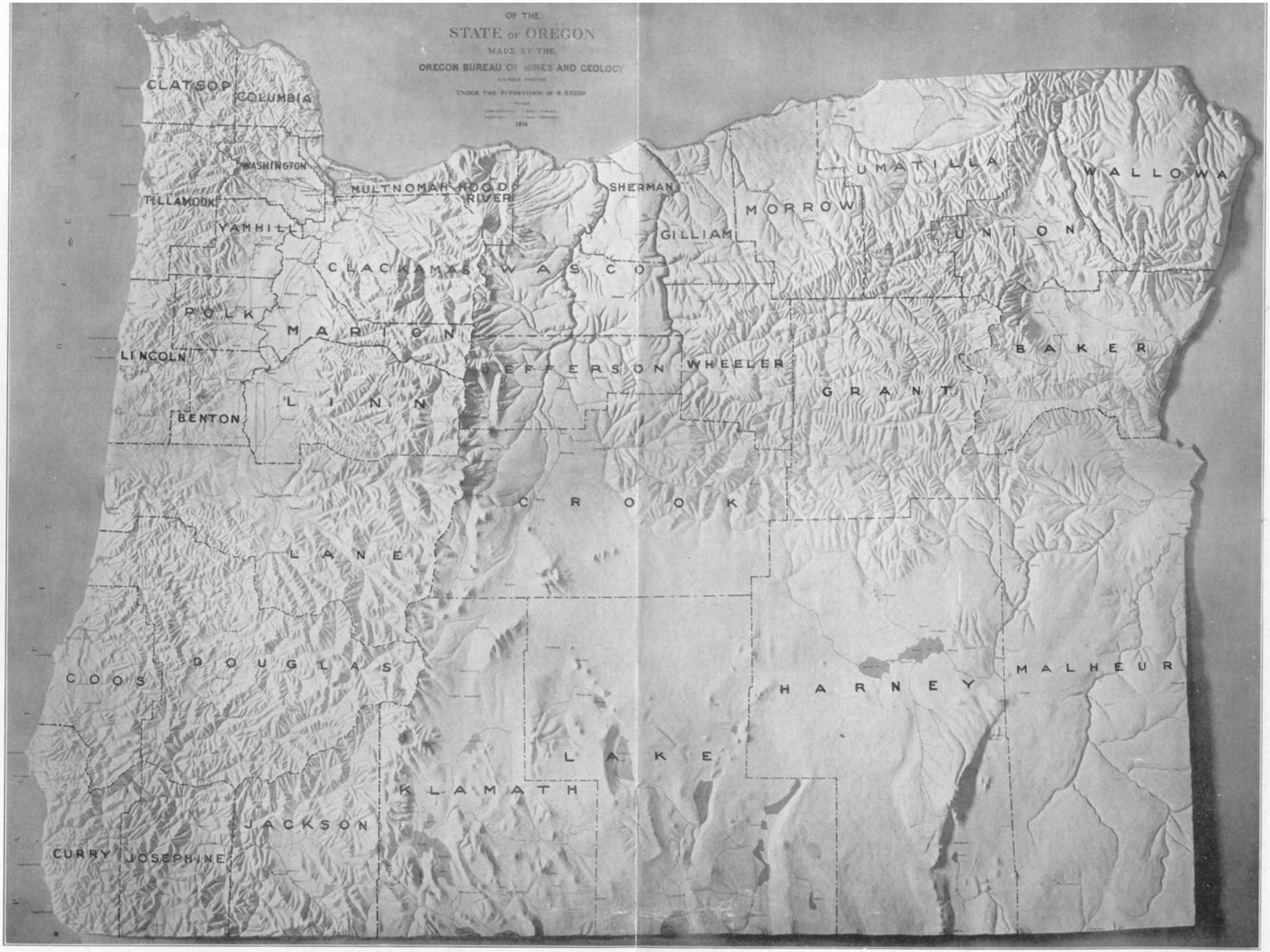

Fig. 1. The Relief Map of Oregon.

VOLUME I NUMBER 7

NOVEMBER, 1914

THE MINERAL RESOURCES OF OREGON

A Periodical Devoted to the Development of all her Minerals

PUBLISHED MONTHLY AT CORVALLIS BY
THE OREGON BUREAU OF MINES AND GEOLOGY
H. M. PARKS, Director

A NEW RELIEF MAP OF OREGON

A relief map of Oregon has just been completed by the Oregon Bureau of Mines and Geology. This map is on the large horizontal scale of 4 miles to the inch, while the elevations and depressions are shown on a scale of 4,000 feet to the inch. The completed map is about 8 by 10 feet.

This map is an actual representation of Oregon as a small portion of the earth's surface, and shows mountains, valleys, streams, and all other natural features just as they exist. Upon it are placed the railroads, cities, highways, and other man-made improvements, so that one has laid out before him, not a mere picture or drawing, but a reproduction of Oregon herself, so that every part may be seen at a glance.

Each map is attractively mounted and framed so that it is suitable for installation and use for any desired purpose.

Dr. Solon Shedd, professor of Geology in Washington State College, did the necessary field work and constructed the original map, or positive, for the Bureau of Mines and Geology. A negative has been cast in plaster from this original and from this negative as many duplicate maps may be made as are needed. The cost of a completed map, showing county boundaries, rivers, railroads, principal cities and towns, chief mountain peaks, lakes, and any

other matter that may be put on the map to adapt it to any particular purpose, will be near 100 dollars.

Professor Shedd has prepared the following brief statement of the method of constructing the map and of the important uses which it may serve. A photograph of a finished map is reproduced in fig. 1.

THE CONSTRUCTION AND USE OF THE RELIEF MAP

BY S. SHEDD

The practical use to which topographic models or relief maps have been put has so widened in the last few years that they are rapidly coming into favor for other than purely scientific purposes. The value of maps of this kind is also being more appreciated for illustrations and instruction.

Ordinary topographic maps representing by contour lines the elevations and depressions of the earth's surface, are now demanded in engineering work of practically every description. Maps of this character afford a ready means of bringing out the configuration of the country in a simple manner. Splendid maps of this kind are made by the U. S. Geological Survey and by some of the state geological surveys. Persons not skilled in the interpretation of contour maps are not able many times, however, to understand them, and it may then be necessary to represent the same area in relief with the rivers, railroads, etc., shown upon a model.

Various methods are used in the construction of relief maps, but the one followed by the writer has given very satisfactory results as regards both accuracy and ease of manipulation. It consists in cutting out the contours, which have been reduced to a uniform scale from available maps and field data, in cardboard of the proper thickness to represent the vertical interval selected, building up and finishing in wax.

In the construction of a relief map the first thing to be determined is the scale on which the area will be represented. Several things have to be considered in determining this point, among which are the purposes for which the map is intended, amount of data obtainable, topography of the area to be modeled, as well as the amount of time and money available for doing the work.

In case the model is to be worked out in minute detail and used for practical purposes, the scale should be much larger than would

Fig. 2. Showing how a relief model is built up in its first stage, by nailing one on top of another, the successive contours cut from cardboard. In the lower and in the extreme upper parts of the view, the topography is comparatively mild; while the irregular shapes and greater number of layers in the middle portion of the photograph indicate a region of intricate topographic features.

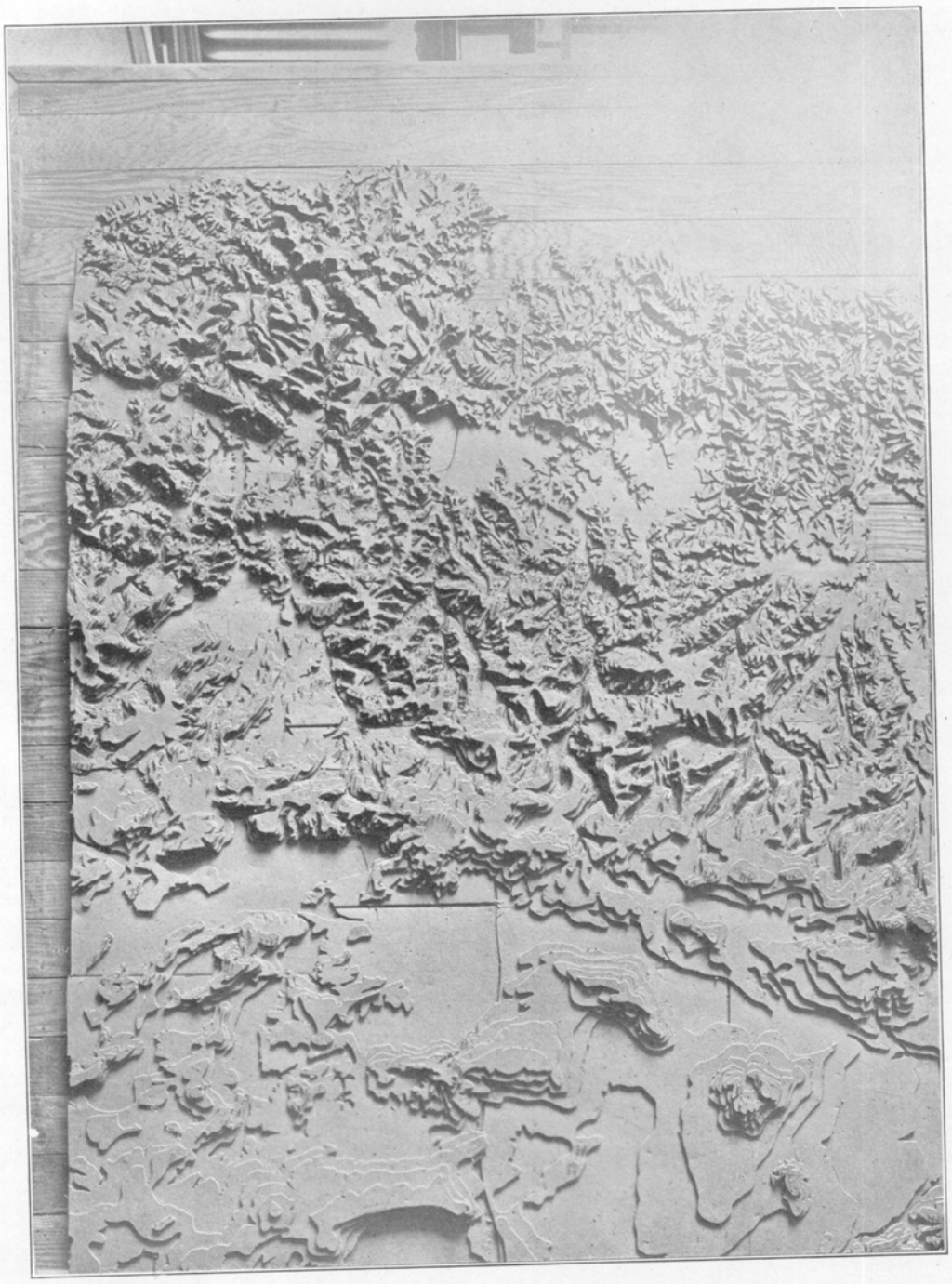

Fig. 3. One quarter of the relief map of Oregon in the first stage of the process of making. The cardboard contours over which the wax is to be modeled are all fastened in their proper positions. This view shows also, to some extent, the way in which the wooden base is built.

be necessary if it were intended to give only a very general idea of the country modeled. After the horizontal scale has been determined the next step is to procure a good contour map of the area to be modeled. If such a map can not be had, one must be made and from it must be decided what shall be the ratio between the horizontal and vertical scales. The aim should be to have this relation such that the slopes will look natural. Before deciding on the vertical scale, sections should be constructed at different places across the map. Various vertical scales should be used in these cross-sections, the sections then studied carefully, and the scale adopted that makes the most natural appearance.

Persons attempting the work of relief map making should have a thorough knowledge of how topographic maps are made, and of office practice, as well as possess skill in the use of tools and in the manipulation of materials. A thorough knowledge of topographic forms is also needed such as can be obtained only by a very careful study of the features of actual land surfaces of many types.

When the scale of the map has been determined, a good strong base on which to build it must be provided. This should be made of good lumber that has been thoroughly seasoned so it will have the least tendency to warp and crack. A very good way to construct this base is to use four thicknesses of half-inch lumber. Two thick-

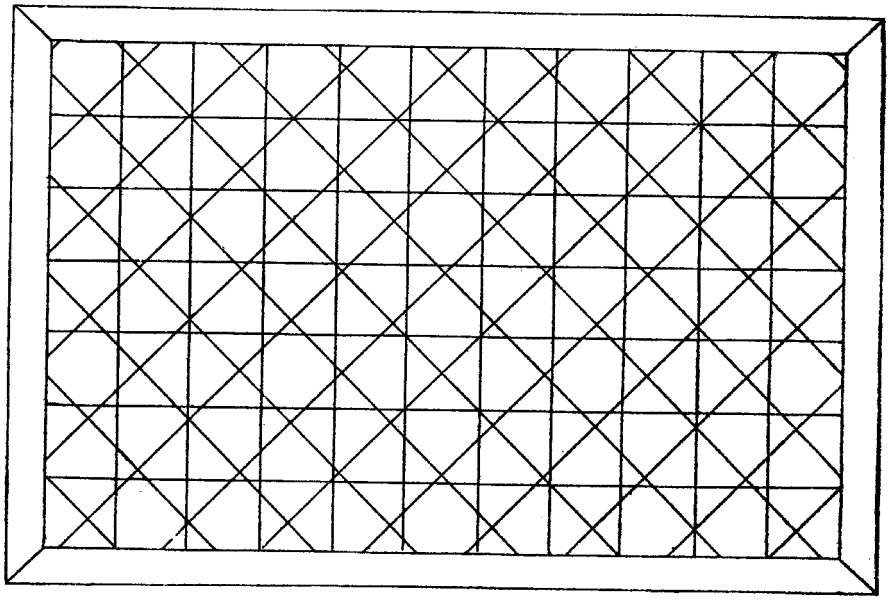

Fig. 4. Diagram showing how the base for the relief map is built; made of four thicknesses of half-inch lumber so as to prevent warping. Not drawn to scale.

nesses of the lumber should extend diagonally across the base in opposite directions; the other two, one above and the other below the diagonal ones, should be placed in such a way that they will cross the base in opposite directions and at right angles to each other. Surrounding these should be a border made of one by two-inch lumber on edge and firmly fastened to the base. A strong border of this kind will greatly assist in preventing the base from warping. The illustration (fig. 4) shows the manner of constructing this base.

The baseboard having been prepared, the outline of the map and the first contour should be transferred to it. This may be done by placing carbon paper on the base, laying the map over this, and then tracing with a stylus the lines to be transferred. The contours are transferred to the cardboards in the same manner. The thickness of the cardboard to be used in building up the map is determined by the vertical scale of the map and the distance between the contours. Suppose the vertical scale of the model to be constructed is 4,000 feet to the inch, as was used in making the Oregon map, and that the contour interval is 500 feet. In this case there would be as many cardboards to the inch as 500 is contained times in 4,000, or 8. Each cardboard should then be just one-eighth of an inch thick. Transfer both the 500 and the 1,000-foot contours to the cardboard. Then with either a jig-saw or a small band-saw first cut the outline of the 500-foot contour and nail it to the baseboard using glue if necessary, in the position marked for it. Proceed in like manner to saw the 1,000-foot contour and to transfer at least parts of the 1,500-foot contour, so the 1,500 layer may be placed in its proper position. The 1,000-foot cardboard is then nailed down in its correct position.

Proceed in this way until the greatest elevation of the map is reached, always marking each cardboard with two lines, one along which the cutting is to be done, the other as a guide for the position of the next layer above. When this is completed the relief appears in successive terraces one-eighth of an inch in height, each step representing 500 feet, and in outline corresponding to the 500-, 1,000-, 1,500-foot, and so on, contours. This step in the process of making such a model is shown in the accompanying illustrations (figs. 2 and 3).

Fig. 5. A close view of a portion of the unfinished relief map, showing below the uncovered cardboard contours, and above an area in which the cardboard is being covered with the modeling wax to reproduce the exact surface features.

Fig. 6. One quarter of the relief map of Oregon completed in wax modeled over the cardboard contours. It is from this original model that a negative is cast in plaster from which as many duplicates of the original may be made as desired.

The model is now ready to have the topography worked over the cardboard. For this purpose the following preparation is used.

Beeswax	16 parts
Venice turpentine	4 parts
Corn starch	8 parts
Venetian red	1 part
Sweet oil	1 part

Melt the beeswax, add the Venice turpentine, sift in the corn starch, stirring the mixture thoroughly during the addition of the starch, after which the Venetian red or other coloring matter, together with the sweet oil, may be added.

The different ingredients in the above mixture are inclined to separate somewhat, and, on account of this, the mixture should be stirred until it is almost cold or at least until it begins to thicken. As soon as the mixture is cold it is ready to use. The wax should be of a consistency to work easily and this can be obtained by regulating the amount of sweet oil in the above formula. Very little heat softens this wax, the heat of the hand being sufficient to make it very pliable.

At this point the skill and knowledge of the topographer come into play in bringing out the finer details of the topography from the contour map between the successive steps formed by the cardboard. It is here that the mere mechanic may fail completely. One is here again strongly reminded that in order to model well he should have a thorough knowledge of topography obtained from a study of topographic forms in the field. This, along with mechanical ability and a high degree of patience, are requisites for good relief map making.

The tools employed may be made of hard wood, bone, or iron, and may be of various rounded forms and sizes, depending much on the character of the topography to be molded and, therefore, on the intricacies of the various shapes that are to appear on the finished model. In giving the final touches to the wax a little sweet oil used on the tools will be found very helpful (see figs. 5 and 6).

The original wax map may be finished in any suitable way and itself used if so desired, as the above wax is very durable and will last for a long time. Usually, however, the wax relief is employed only as a model from which to cast in plaster a negative or mold. This may be done by first giving the wax map a coat of shellac, and when this has had time to harden, applying a coating of oil

over the shellac to prevent the plaster from sticking to the map. Enclose the oiled map in a wooden frame and place on a flat surface to secure an even distribution of the liquid plaster when it is poured over it.

The correct amount of water should be put into a suitable vessel and into this plaster of Paris of good quality is sifted, and the whole stirred rapidly to prevent the formation of lumps and air bubbles in the mixture. Plaster is added until the mixture has about the consistency of cream, when it should be poured over the oiled map. It is then allowed to stand until the plaster is partially set or hardened, when the whole may be turned over and the wax model separated from the cast. The mold should be retouched and all imperfections corrected, allowed to dry thoroughly, after which it may be given a coat of shellac and is then ready to use. If time is an important element, the mold may be used before it is thoroughly dry.

Positives, or duplicates of the original wax-cardboard model, can now be made by casting from this negative mold. To make a positive the mold is oiled and plaster mixed and poured into it, proceeding precisely as was done in making the negative. Large casts may be strengthened in various ways, such as putting iron rods, wire netting or hemp in the plaster. Thick casts may also be hollowed out somewhat on the under side and made lighter in weight. Mixtures of various kinds other than plaster are also used to lighten large casts.

The finish of the model depends entirely on the purpose for which it is intended. It may be painted any color desired and the surface features, such as streams, towns, roads, railroads, etc., put on the painted surface either with paint or India ink. The finishing of the map is a very important matter and one that should be done by a skilled draughtsman. Unskilled work in drawing and lettering may ruin the appearance of an otherwise good map.

In the case of very large maps it is necessary to make them in sections so they may be handled more easily and safely. The Oregon map was constructed in four sections, the sections being worked together so they would fit perfectly.

USES OF RELIEF MAPS

Relief maps or models are useful in many ways, the following being some of the most important.

In the teaching of physiography they bring out in a way that

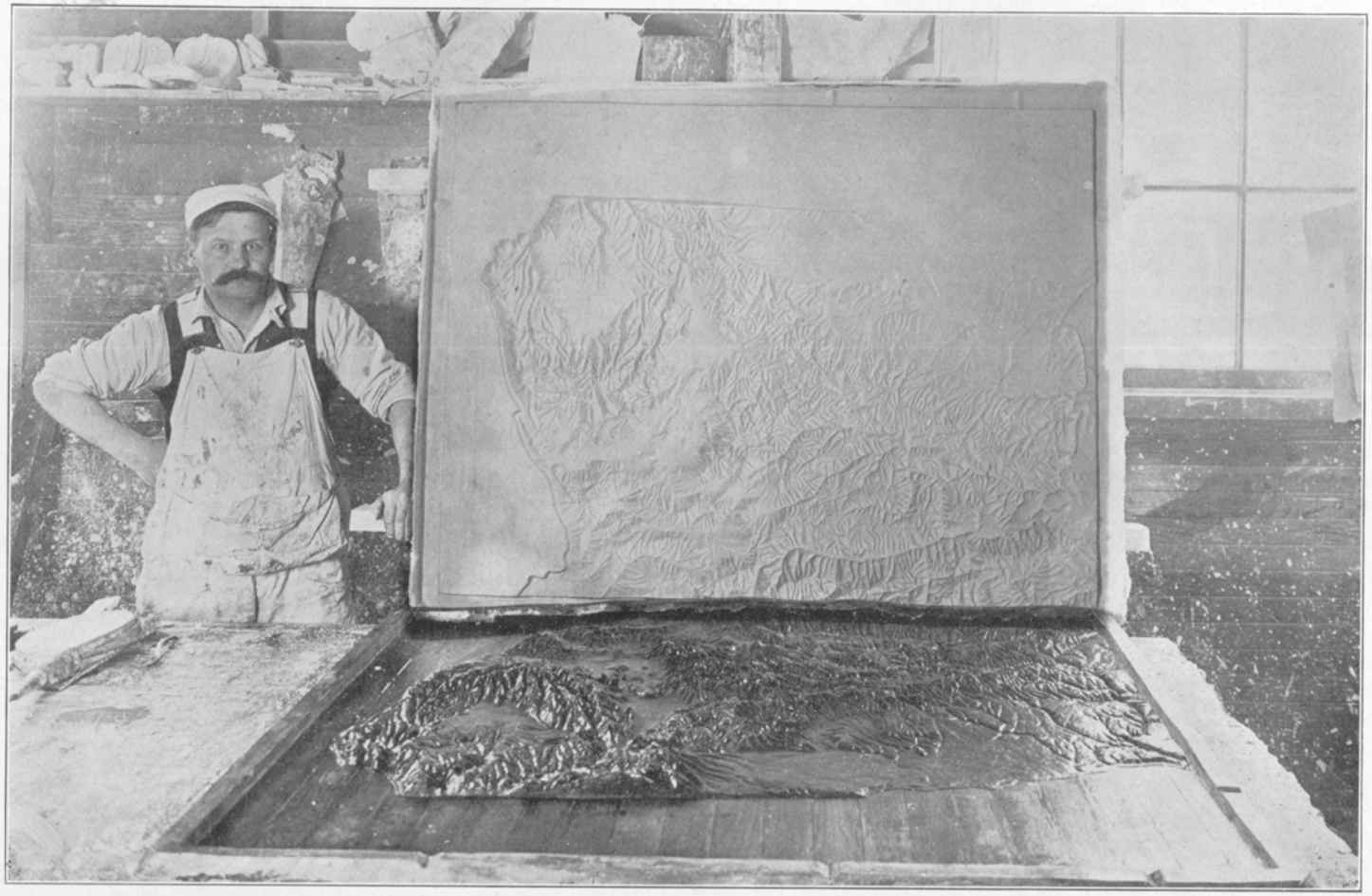

Fig. 7. Making the plaster negative of one-fourth of the Oregon relief map from the original wax model. The model is seen lying flat, while the cast, which has just been lifted from it, is standing vertically.

nothing else can the surface features of a locality. They show the relation of the mountains to the valleys and plains, the relative altitude above sea level of each of these, and their relative areas. They are especially helpful in explaining the cause of the climate of various localities, why in some places a large amount of precipitation occurs, and in others very little, why we have extremes of heat and cold in certain regions and an even temperature in others.

Models may also be of very great value in the teaching of geology in its various phases. This is especially true in regard to structural geology as the student in this way can have before him, in miniature, a representation of the rocks as he would see them in place in the field. Models of this kind may be very useful in the study of problems connected with forestry, agriculture, horticulture, grazing and many others of related character. For all of these purposes and in order to present to the young people of the state an exact conception of its many and varied surface features, and their practical bearings and meaning, one of the Oregon relief maps should be put into each high school of the state and used for reference in all economic studies relating to the state.

A relief map is very helpful in working out the geology of a region. When the nature and position of the rock strata are represented on a map of this kind, their relation to the topography is much better understood. The geology has much to do with determining the topography, and when these are both represented on a single model, it will be found of great value bringing, as it does, all of the facts in their proper relationship at once under the eye.

Instances are known where topographic models of this type have been of great assistance in cases of litigation. By the use of such a model a jury can very often obtain a truer conception of the actual position of a vein or its extent, the exact slopes or character of an area, or of other features in dispute, than they could by actually seeing them in the field.

In solving many of the every day development problems the relief map may be made an indispensable aid. Presenting accurately in one view, as it does, the actual features of Oregon's land surface on a large scale, a study of it will be an essential preliminary and accompaniment to the laying out of highway systems, to the location and development of water power and irrigation projects, in preliminary surveys for railroads, and in other enterprises in which a knowledge of distance, relief and grade is prerequisite.

No other means is so well adapted to exhibiting the resources of the state as is the relief map. Agricultural valley lands, foothill belts, rugged mountain slopes, forested and barren areas, may all be picturesquely yet accurately indicated. The position of lands in cultivation, fertile lands that are unsettled, mining regions, national parks and a multitude of other details of economic importance, may be accurately shown on the map in their correct relationship to public highways, railroads, streams, cities, etc. The relief map provides an eminently more suitable means than has before been available of showing to our own citizens, and to the vast number of inquirers who may become residents of Oregon, the character of the state and what its developed as well as its potential resources are.