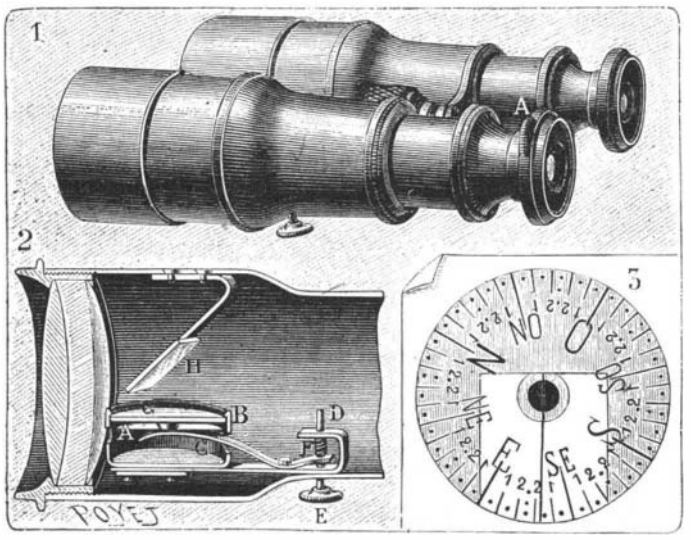
THE COMPASS FIELD GLASS.

All of our readers are acquainted with the wonderful instrument called a field glass, that permits of distinguishing objects at a distance with great distinctness. This apparatus is much used by our officers in military reconnoissances. Up to the present, however, it has had one great fault, that of giving no indication as to the exact situation of the point observed. This latter could be designated only by a few vague terms, such as to the right, to the left, etc. Mr. Geraud, a cavalry officer, has just overcome this defect by adapting to the ordinary field glass a compass that exactly determines the directions in which the observations are made.

The compass field glass, the general appearance of which is shown in Fig. 1, consists of an ordinary double field glass, in one of the parts of which is inclosed a compass with its rose arranged horizontally. Fig. 2 shows the details of construction. At A we observe, mounted upon a pivot, the movable rose upon which is fixed the magnetized needle. A flexible strip, C, terminates at F, where a spring held by a rod, D, keeps it constantly pressed against the rose, A. On the outside of the field glass there is a button, E, which permits of annulling the action of the spring, F, and of setting the rose free. The pivot and the compass are inclosed in a box, B, placed in the field glass, usually on the left side. At the upper part there is a glass, G, upon which is traced a line that serves as a datum mark for the readings. This line is directed according to the axis of the field glass, and, consequently, according to the line of sight At H there is a properly inclined mirror which reflects the rose of the compass and sends the rays in a horizontal direction.

The rose is provided with peculiar divisions for clearly fixing the positions of the objects observed. It is formed of a circle divided into eight equal sectors through four diameters. Four divisions correspond to the cardinal directions N., S., E., and W., and the four others to the collateral diameters. Fig. 3 gives the plan of this rose. One will remark the illuminated part, which is the only one visible in the apparatus. The angle comprised between a cardinal division and the contiguous collateral division is divided into ten equal parts, each of five grades.* We have entire lines marked 1 and 2 to the left and right of a median division designated by three dots. The other intermediate divisions are indicated by one dot. The reading is done by first enunciating the cardinal or collateral direction nearest the datum line, then the following direction, and by indicating the exact division occupied by the datum line. For example, in the position of the rose represented in Fig. 3 we read S. E.—E. 17 grades. Such determination will permit of finding exactly again upon a map the situation of the place observed.



THE COMPASS FIELD GLASS.

In order to render the vision very clear, it has been necessary to adopt an optical arrangement that allows the divisions of the rose of the compass to be read with great ease without, however, interfering with the binocular vision. To this effect, the head of the field glass is provided with a double convex lens set into a movable collar, A (Fig. 1). The refracting power of this lens is so calculated as to annul the concave ocular of the field glass on the one hand and, on the other, to form a magnifying lens for facilitating the reading of the compass. This lens can be easily shifted by pressing upon the movable head, A, and is therefore capable of rendering to the field glass its special properties for binocular vision.

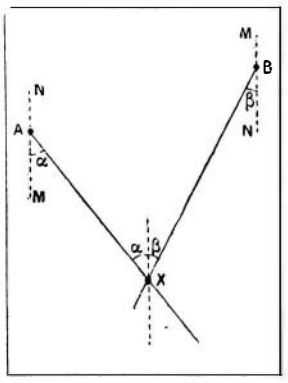


FIG. 4.—Construction to permit of obtaining the exact position of the point × upon a map by means of the observed angles α and β.

All these modifications can be easily introduced into the ordinary field glass. The instrument under consideration lends itself to a most interesting series of determinations. It is possible to recognize upon a map the point where one chances to be, to make a hasty survey upon horseback, to establish an optical post at an indicated point upon a map, etc. We shall select an example of the most practical problems for making it known to our readers.

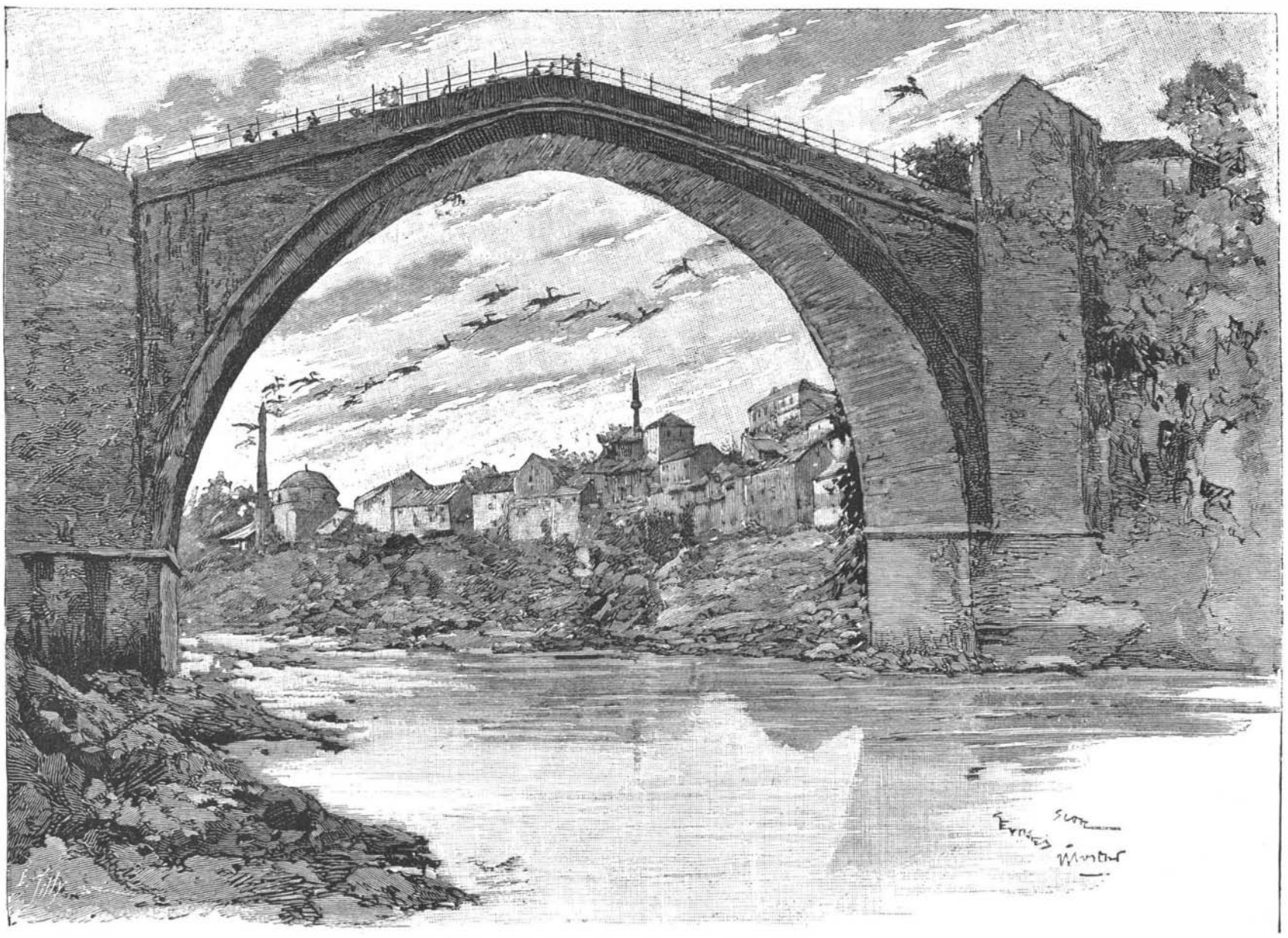
We find ourselves at a point, χ (Fig. 4), whose situation is totally unknown to us, and we desire to determine such point. In the vicinity there are two other points, A and B, such as a city, a tower, a hill, etc.—in a word, two points that we can easily observe. We take a look at these two points in succession, and note in each case the divisions indicated by the position of the compass with the datum line. Supposing α and β to be the divisions observed upon a map, let us fix the points, A and B, whose positions are known. Through each of them let us pass a line, M N, parallel with the N S direction, which is the line of the magnetic meridian in these places. The correction relative to the magnetic declination is made, and, consequently, the geographical meridian is confounded with the magnetic. Starting from M A, let us inscribe the angle, α, and from N B the angle, β. Let us draw two straight lines forming such angles. They will meet each other at a point, χ, which is the exact position of the point sought.

As may be seen from this brief description, the compass field glass is destined to render great services. The apparatus, which is very ingenious and based upon the simplest principles, permits of fixing, by measurements sufficiently precise for practice, the vague and uncertain results that up to the present have been furnished only by observations left to the appreciation of each person.—La Nature.

* The "grade" is the division adopted in the army. The circumference is divided into 400 grades.

THE ROMAN BRIDGE OF MOSTAR.

The border lands of civilization are nearly always interesting, and Herzegovina is no exception to the rule. This province of Europe forms a part of Bosnia and is surrounded by Dalmatia, Croatia, Bosnia, Servia and Montenegro. The chief town of Herzegovina is Mostar, the meaning of this word being "old bridge." When Sir Gardner Wilkinson visited Mostar shortly before the publication of his work on Dalmatia and Montenegro, in 1848, the difficulties which were thrown in his way were almost insurmountable · but now Mos-

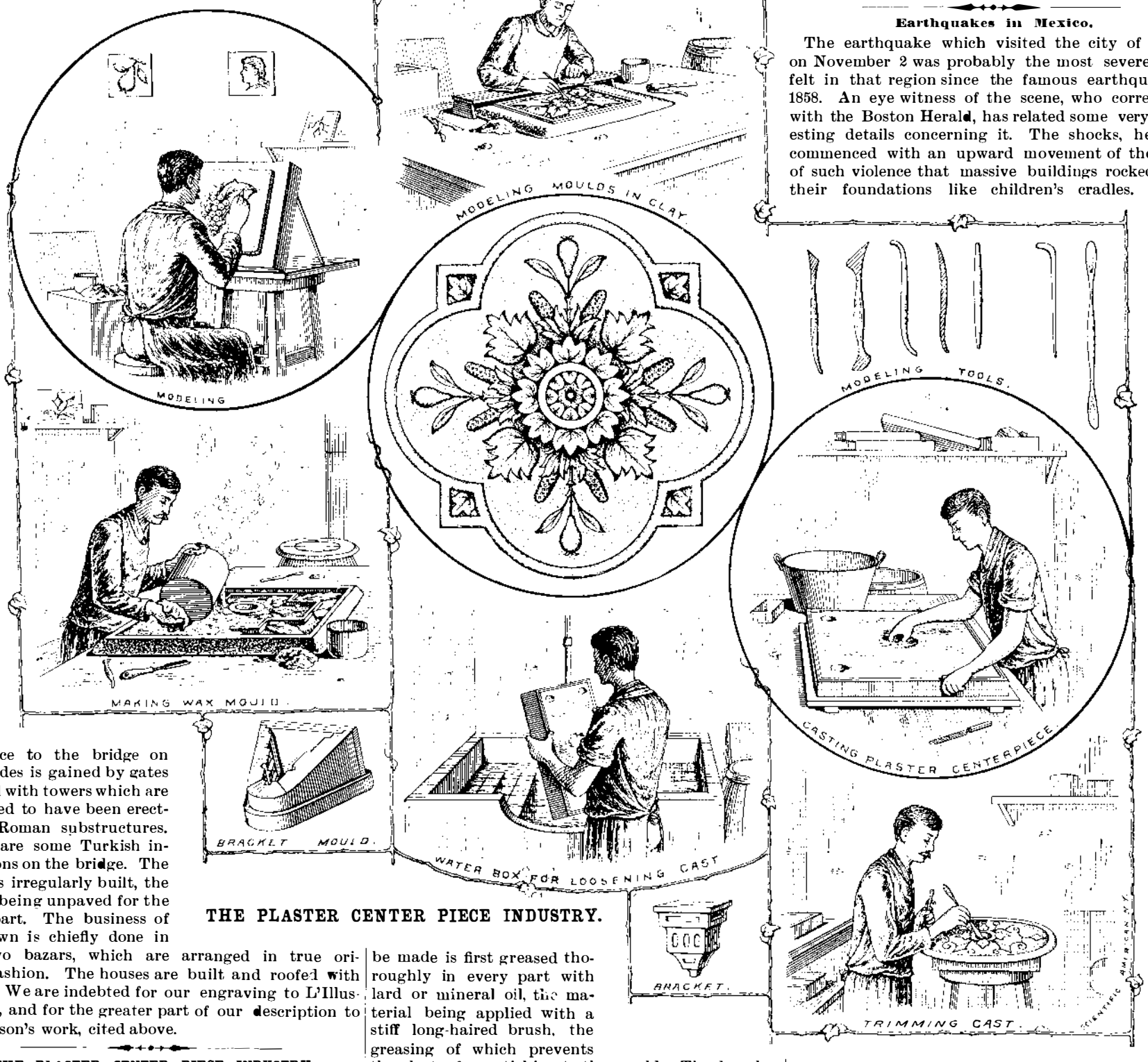


THE ANCIENT ROMAN BRIDGE AT MOSTAR.

tar is a station on the Bosnia State Railway, and has 11,000 inhabitants, who are of many nationalities, Herzegovina having passed from Turkish rule to Austrian military occupation in 1878.

Mostar is situated on the Narenta, a brawling stream, thirty-five miles from its mouth. The banks are high and rocky, and are connected by a beautiful bridge, for which Mostar has always been celebrated and which forms the subject of our illustration. It is a single arch, the span being 95¼ feet, and at low water the parapet is 76 feet above the water and at high water it is sometimes only 44¾ feet from the water's surface. The breadth of the arch is 14·2 feet, the roadway 13·2 feet. On the north side is a stone conduit for conveying water to the eastern portion of the city. The bridge rises about ten feet in the center, giving an effect of lightness which was evidently not intended in the original designs. The building of the bridge is attributed to Trajan or Hadrian, about A. D. 120, but the Turks have carefully concealed the Roman masonry with small stones, which give the bridge the appearance of a Turkish construction. Both the inherent grandeur of the arch and tradition favor the belief that it was constructed by the Romans.

Entrance to the bridge on both sides is gained by gates flanked with towers which are supposed to have been erected on Roman substructures. There are some Turkish inscriptions on the bridge. The town is irregularly built, the streets being unpaved for the most part. The business of the town is chiefly done in the two bazars, which are arranged in true oriental fashion. The houses are built and roofed with stone. We are indebted for our engraving to L'Illustration, and for the greater part of our description to Wilkinson's work, cited above.



THE PLASTER CENTER PIECE INDUSTRY.

The center pieces, brackets, and moulding used in the decoration of ceilings in public buildings, dwellings, etc., are made principally of plaster of Paris. A model is first made of clay, from which a mould consisting of resin and beeswax is formed, into which the plaster of Paris center piece is cast. The first process is the modeling of the design in clay from a sketch or drawing. This is done by spreading out a quantity of finely tempered and plastic clay on a hard wood or marble-covered table, the design, if a floral or fruit piece, being modeled into shape by the fingers and by the use of a number of wood, ivory, bone and steel tools, the modeler using them for finishing off neatly and sharply the parts which cannot be reached by the fingers. The best workman is one who can do most toward producing the required forms with his fingers unassisted by artificial tools, as a greater degree of ease and freedom almost always results from the use of the hands alone. While the modeling is in progress the operator keeps the clay moist and plastic by adding water to it. A damp cloth placed over the design or model keeps it moist when not worked. In modeling bass-reliefs the operator applies the clay to a slab of slate or a metal-covered block, which can be raised and lowered at will. Some models are made of soft wood shaped out by the usual chisels, gouges, etc. The clay model when completed is allowed to become hard. A coating of shellac is then applied and the sides built up with a quantity of soft clay. A solution composed of melted beeswax and resin is then poured over the mould, the casting of which forms the wax mould from which the plaster of Paris cast is made. About 5 pounds of beeswax to about 7 pounds of resin are required to form a 12 pound mould, it taking about half an hour to harden. The moulds when cast are about 2 inches in height and ranging from ½ inch to 1 inch in thickness. The wax mould when a plaster cast is to be made is first greased thoroughly in every part with lard or mineral oil, the material being applied with a stiff long-haired brush, the greasing of which prevents the plaster from sticking to the mould. The dry plaster of Paris is first mixed with water by hand in a tin vessel. To form a center piece about 2 feet in diameter, the operator mixes from 5 to 6 pounds of plaster in about 3 quarts of water to the consistency of cream, an expert being capable, during the process of mixing by his hand, of judging when the solution is ready by the sense of feeling. The material is then poured from the vessel into the mould, which is placed on a raised wooden frame, the center of which is cut out. The center of the mould, which projects below the bottom where the gas pipe passes through, rests over the opening, causing the mould to set evenly on the frame. After the plaster of Paris has been in the mould a few moments, the operator takes a portion of the plaster out of the cast where it is likely to be thick and heavy and spreads it over the thinner parts. The edges are then fastened and the material smoothed over by the operator passing a smooth wooden bar or stick over the surface. The cast is then allowed to harden, which takes about half an hour. The next operation is the taking of the cast from the mould. This is performed by submerging the mould into a water box for a few moments, the cast coming in contact with the water causing the plaster to shrink and raise slightly. The mould is taken out as soon as the cast raises, and turned bottom up. The sides and bottom of the mould, which is elastic, are then pressed in and out by the fingers, the operation causing the cast to loosen and drop out. Before the cast is dry the back is scored with a knife, which causes it to hold when plastered to the ceiling. The cast is then trimmed and the center hole cut through with a gouge. Lukewarm water in winter and cold water in summer is required for loosening the casts from the moulds, the wax being very sensitive to heat and cold. The cost of the wax used in making the moulds ranges in price from 30 cents to 38 cents per pound, and the resin from 3 cents to 4 cents per pound. A single operator can make a cast about 2 feet in diameter in about one hour. Plaster of Paris center pieces run from about 1 foot in diameter upward and are sold to the trade at from 50 cents to $2 each, according to the design. The sketches were taken from the works of Charles Mattern & Son, Jersey City, N. J.

Earthquakes in Mexico.

The earthquake which visited the city of Mexico on November 2 was probably the most severe shock felt in that region since the famous earthquakes of 1858. An eye witness of the scene, who corresponds with the Boston Herald, has related some very interesting details concerning it. The shocks, he says, commenced with an upward movement of the earth of such violence that massive buildings rocked upon their foundations like children's cradles. Many roofs were completely wrecked and large cracks were made in walls of solid masonry. The cathedral also sustained serious injuries. During the most violent part of the earthquake the pictures on the walls swayed to and fro, and telegraph cables swung in the air like clothes lines. The horses on the streets were unable to keep on their feet, and water was hurled out of the public fountain basins. The rocking was accompanied by loud, rumbling sounds which added to the terror of the people. The actual loss of life has been fixed at fifteen lives, and long lists of casualties are reported. The earthquake was also accompanied by the eruption of the volcano Colima, which continued long after the shocks had subsided to emit clouds of steam. There is a theory that on both coasts of Mexico there are submarine volcanoes which are active during seismic phenomena on the land. The scientists of the region visited by the earthquake assert that the shocks had no connection with the great disturbances of the earth's crust in South America.