great as the rectilinear velocity of the axis. The periphery does not move at the bottom. All parts of the periphery move with equal velocity around the axis.

(443) M. A. P. asks (1) how to make paste such as bookbinders use. Do they use glue or flour paste? A. Ordinary flour paste is generally used, though sometimes a little glue is added to make the paste tougher. Some antiseptic, such as carbolic acid or alum water, is added to prevent souring. 2. How engravings are made by the process known as "zinc etching." Is it the same as producing engravings from zinc plates by the action of acids? A. The process is the same in principle, but in the ordinary "process" plates, for printing with types in a form, the blacks are in relief and the whites sunken, while in an etched plate the whites are in relief and the blacks sunken, the printing then being done as that of a steel engraving. Nitric and muriatic acids, of various degrees of strength, are used in each case to bite out the metal. 3. Where can the zinc plates be procured, and what are their cost? A. Most large electrotyping establishments could furnish them to order. They are not on sale by dealers, and are specially prepared of soft zinc, with a surface as smooth as glass, by an expert in this line. 4. Would like a short description of how electrotyping and stereotyping are done. A. For electrotyping, the type form is well brushed over with plumbago—a wax mould is then taken, and a thin electro deposit of copper made therein. This thin deposit of copper is stripped off and baked with type metal flowed on. For stereotyping a plaster cast is made of the face of the type to form a mould—or the mould may be made of a kind of papier mache substance beaten into the face of the form. The face moulds so made are placed in another mould or form to give the proper body or backing and receive the melted type metal.

(444) D. T. E.—Printers' rollers are not usually made with India rubber, except such as are used on newspaper presses maintaining a high rate of speed. For ordinarily fast presses on book work the following is a good composition: 10½ lb. best glue, 2½ gals. black molasses or honey, 2 oz. Venice turpentine, 12 oz. glycerine. The quantities of glue and molasses will be slightly varied according to the season, comparatively more glue being used in summer than in winter. If French glue is used, it will be necessary to let it soak overnight to take up the right quantity of water, but most domestic glue will take up sufficient water in about two hours. The turpentine and glycerine should be added and well mixed with the composition just before pouring. When rubber is used to make the black composition described in the SCIENTIFIC AMERICAN of January 12, the rubber should be cut in fine shreds and dissolved in benzine, ether, or bisulphide of carbon, *not* in alcohol. It should be mixed with the turpentine and added to the composition the last thing before pouring, the glycerine and vinegar being mixed with the glue and molasses a short time earlier, after the latter has become well combined in a kettle in a water bath over the fire or in a steam-jacketed kettle.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(445) M. E. G.—Please state why throwing salt upon a fire will put out a burning chimney? Also please state how the magicians do the trick of raising tables, chairs, etc., by simply laying their hands upon them? This is an old performance, and is now being done by Kellar.

(446) H. B. H. writes: Will you please advise us of the mixture used for coating iron so as to give it the dull black finish seen in chandeliers and andirons? It is called Berlin black, and will not rub off.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(20) Halifax.—Relief Maps.—Although not sure of the method used in Germany, there is one way which, although it involves considerable expenditure of time and materials, produces a map in relief which is extremely accurate and would command extensive orders were the work carefully and accurately performed. Suppose you have a map of a section of country on which are marked contour lines made by passing horizontal planes at vertical distances of ten feet, or any other distance. Take sheets of cardboard so that the thickness shall represent one foot, then ten superposed will give ten feet. The thickness of the cardboard is of course the unit of your scale, both vertical and horizontal. Now cut out pieces of cardboard of the same size and shape of the horizontal space embraced by the different contour lines. Then on your map draw in between the contour lines and approximately parallel to them nine other lines, and cut pieces of cardboard corresponding to them. Superpose these in their regular order, and you have the rough formation in relief of your map. The pieces of cardboard are pasted together and carefully pressed to keep the whole mass uniform. Then smear wax over the whole, in order to make a smooth surface. Different colors will represent roads, grass, rivers, etc. Trees or forests can be represented by dried green moss. Houses and other buildings and constructions are made of wax. In the practical work of making such a map, other details may come up, but they will generally be such as will present little difficulty to any one at all conversant with modeling. The chief difficulty lies in procuring maps with contour lines marked on them.—S. R., Jr.

(245) C. T. I.—Battery Zincs.—The writer has had very good results from zinc plates, built up from thin sheet zinc (stove zinc, the only zinc to be had at the time). These plates were built up by folding over and over and hammering down the fold each time, so as to produce a compact plate of the size required. Building up by cutting several pieces, all to the size required, and then fastening together, was very good, but not so good as the building by folding a long strip. No trouble was had in amalgamating, as the thickness of the plate, after being built up, made it stiff enough to stand well, though the mercury struck clear through each sheet, as was the case. The extreme top of the plate, to which the copper wires were fastened, was not amalgamated, for say a half an inch, to avoid breaking and the brittleness that would have resulted had this end been amalgamated. These plates stood long and severe use, kept their amalgamation perfectly, and consequently never showed any local action. Riveting the plates could not well be done, unless zinc rivets were used. Any other metal would at once make local action from the galvanic couple that would be set up by its presence in the zinc plate, even though it was amalgamated. The four-cell battery mentioned would prove all right if the motor is wound for a low tension current. It would be better yet to use five carbons and four zincs, so as to have a carbon plate for the outside on each side of the cell, and so reduce resistance by having each zinc plate with carbon plate on each side of it. The size of receptacle will, of course, determine whether this can be done or not, and the winding of the motor will determine whether four or eight cells should be used.—C. D. P.

(320) S. L. F.—Stay Bolts.—The pressure or strain upon a stay bolt in series forming squares is the square of the distance multiplied by the pressure on the boiler, or in your case 6 in. × 6 in. × 100 lb. =3,600 pounds strain on the stay. If the areas are not squares, divide the distances between stays and average for the area.

(321) S. H. P.—Propeller.—You will require 65 horse power, besides power required for friction of engine and shaft, and a propeller of four blades, 38 in. in diameter.

(329) D. Y. M.—Softening Water.—See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 629, 270, 187.

(329) How to Soften Water.—If the hardness is due to calcic carbonate, it can be removed by boiling the water. If it is due to calcic sulphate, it can be removed by adding sodic carbonate (common washing soda). In the last case two new substances are formed. One is insoluble and settles, the other is soluble, but does not act on soap.—W. F. W.

(330) S. T. R.—Steam in Boiler Furnaces.—Steam from the boiler or exhaust has been used many years for increasing the intensity of the fire by injecting it under the grate when the draught is otherwise good, or otherwise by using a steam blower which carries a portion of steam under the grates with the air. One of the oldest practices among engineers or firemen is to wet the ashes or throw water on the ash hearth, which evaporates and feeds the fire with moisture. The steam in contact with the hot coal is decomposed, producing carbonic oxide and hydrogen, which are both combustible in contact with air.

(334) W. L. G.—1. Starch granules may be well mounted dry, but best in Canada balsam. If the grains are laid upon the slide, and as small a portion as possible of balsam diluted with turpentine be applied, they will cling to the slide and allow pure balsam to flow over them without making air bubbles. To mount blood corpuscles, cover the slide on the spot required with a coating of blood as thin as possible and allow it to dry. Fasten on cover with a ring of varnish. 2. Raphides are often mounted dry, but are easily mounted in balsam. 3. The highest power of the Lick telescope is about 4,000 diams. For microscopic mounting consult Mr. Davies' useful little book on "The Preparation and Mounting of Microscopic Objects."—Wm. H. P.

(335) L. W. S.—Cyclones.—1. In the first place, do not call them cyclones; that is a misnomer that the public has fallen into, thanks to the daily newspapers. They are *tornadoes*, not cyclones. Cyclones are storms of a very different character. They are like tornadoes only in one respect, namely, they are both rotary storms. The tornado is a funnel-shaped column of disturbed air, generally about forty or fifty yards in diameter, rotating about a nearly perpendicular axis. It forms in the upper air a few miles overhead and works down to the earth. Its track is generally not more than twenty-five miles until it disappears into the upper air from whence it came. They are caused by strata of warm and of cold air struggling against each other. Take, for example, the tornadoes which struck Pittsburg, Reading, and Brooklyn, last January. They were only local incidents of a general storm, the diameter of which was about 500 miles. The center of the storm was between Chicago and Grand Haven, Mich. Draw a circle of 500 miles radius from the general storm center, and you will find that in the southeastern quadrant of that circle tornadoes will form and will move toward some point in the northeastern quadrant. At 8 o'clock A. M. on January 9, there were southerly winds and very high temperature along the south Atlantic coast. In Florida the temperature was over 70°, while in Pennsylvania it was below 30°. The isothermic line for that day bulges up at Chicago and drops violently downward through Pennsylvania and Northern Virginia. The hot air south of the isothermic line was struggling to get northward, and the cold air north of the line was struggling to get south. It was this struggle that caused the tornadoes. Normally the air is much warmer on the earth's surface than it is skyward, but on January 9, if you had gone up in a balloon at Pittsburg, you would have struck warmer air as you went up. The line where the warm and cold air comes into closest contact was the line where the tornadoes formed. 2. There were probably just as many tornadoes then as now. Remember that they are storms of a very limited area, and in a sparsely settled country they would easily escape observation.—H. S. W.

(336) E. W. T.—Gold Lacquer for Tin.—Use thin copal varnish slightly colored with turmeric and bake in an oven. You can buy the varnishes of any required color for stamped tin work from F. W. Devoe & Co., New York.

(364) M. S. O'K.—Stationary Point in Piston Stroke.—The piston stroke of an engine comes to a dead stop at the end of each stroke in theory as well as in practice. So far as visible means can tell it starts immediately on its return stroke, but actually in theory and in practice it stops for a space of time varying, it may be, with the number of strokes per second, friction, etc. The well known formula for space, s, passed over in time, t, in seconds at a velocity, v, feet per second, is $s=vt$, make $v=0$, as it must be at the end of the stroke, and $s=0$, which indicates theoretically a state of rest.—S. R., Jr.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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