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GLASS MAKING AT THE CENTENNIAL EXPOSITION.

There is no portion of the Centennial Exposition more generally interesting, or which at all times attracts greater crowds of people, than the glass factory. This is located in a separate building, in rear of the huge shed wherein are exhibited the steam sawing machines, and there, for the first time in the history of any world's fair, the visitor may witness the entire glass-making process. Two weeks before the Exposition opened its gates to the public, the fires under the great cluster of pots were lighted, and since then, some seven tuns of materials have weekly been melted and converted into tumblers, and goblets, and vases, and the hundreds of minor articles designed as *souvenirs* of the Centennial.

The operation of glass making begins with charging the pots, which are huge crucibles of clay arranged around the central fire of a huge furnace, the lofty stack of which, always pouring forth smoke, is a prominent object in any distant view of the grounds. In these pots the raw materials, sand, pearlash, lead, soda ash, lime, nitrate of soda, various oxides, etc., are placed, previously being thoroughly ground and mingled with broken glass. Each pot holds about 1,600 lbs. of ingredients, and but half of the total number of pots are worked at a time. A part of the charge is first inserted; then as this melts more is added, and thus the receptacles become gradually filled with melted "metal." The fire is now urged, and the workmen constantly thrust their long iron bars into the viscid dazzling mass, withdraw a huge drop or two at a time, and examine it, until at last the bubbles, which at first are thickly scattered through it, become fewer and fewer; the scum which forms on the surface is ladled off, the heat is carried to the highest degree

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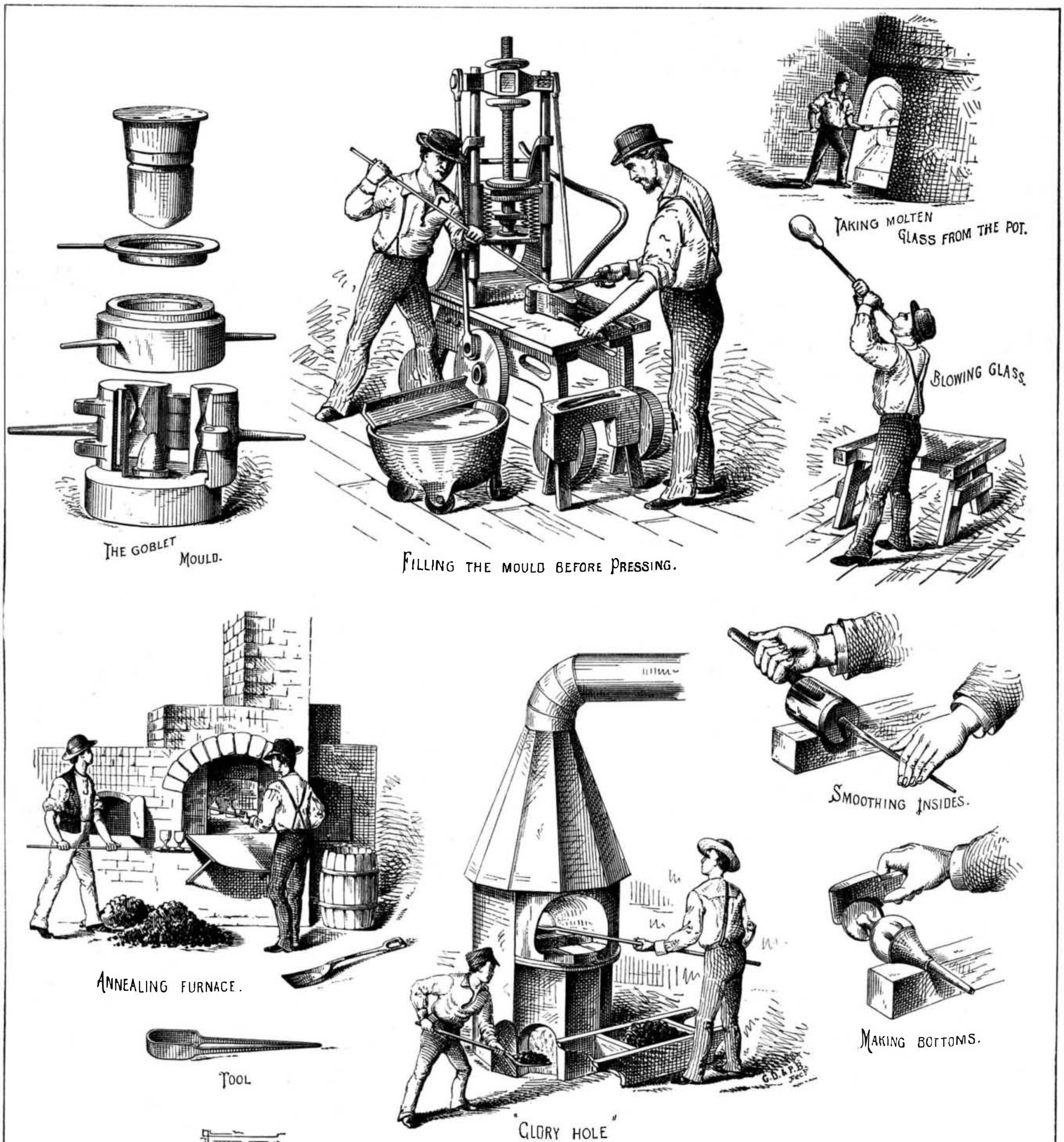


GLASS MAKING AT THE CENTENNIAL EXHIBITION.

Continued from first page.

for some 20 hours, and finally the bubbles disappear, and the now fluid mass becomes homogeneous and clear. Then the furnaces are allowed to cool until the contents of the pots become pasty and viscid, the proper working state; and the heat is subsequently maintained at a degree sufficient to keep the glass in this condition.

At the Exposition, the glass is mostly pressed at once into the required form. Some blown glass is made, but the sketches shown on our initial page relate mainly to the former operation. The mold, which is represented taken apart, so as to show its construction, is one of those designed for pressing goblets. It consists first of two hinged iron pieces, in each of which are hollows, corresponding in shape to the portion of a goblet below the bowl. The ring portion shown, above the mold proper, holds the glass which forms the bowl of the goblet,and the still smaller ring above fits in the one just mentioned and limits the hight of the bowl in the mold. Lastly, the conical plunger enters the bowl portion, and between it and the mold the glass is pressed into proper cup shape.

The mold is placed on the greased metal table of the press, as represented in the sketch, and the plunger is attached to a screw rod which passes through a crosshead which slides on vertical guides. The cross head is eccentrically connected to disks on the side of the machine by pitmans,and to one of these disks is secured the long lever manipulated by the workman. The apparatus being ready, a "gatherer" takes a long iron rod called a punty, to the end of which a little ball of viscous glass is attached. This he dips into the pot of molten glass, and twirls it around until a moderate sized nodule is gathered on the end. Carrying his rod over to the press, he holds it so that the glass slowly drops into the mold, until the workman deems that a requisite quantity has entered, when a pair of shears is used to clip off the material. If too much glass remoins on his punty, the gatherer rolls it along the edge of the iron slab beside the pot of water shown, when the excess of glass falls hissing into the water, and the remainder is rolled into a neat ball. The pressman now pushes his filled mold under the plunger, seizes his lever, and forces the plunger down with such force that the hot glass is driven into every crevice of the mold. A moment of waiting follows, the plunger is thrown up by the action of heavy spiral springs, the mold is drawn back and opened, and there stands the goblet, rapidly changing from cherry red to its natural transparency. An attendant now has ready a punty with a bit of hot glass at the end, which he deftly attaches to the bottom of the article, to serve as a long stem. The goblet is thus carried to the glory hole, a smaller furnace, and here it is reheated. This gives it its subsequent polish. While hot and blackened, it is removed and passed to a workman who sits on a bench on each side of which are long inclined iron-covered arms. Taking the stem or punty in his left hand and resting the object on one arm of his chair, the workman rapidly rolls it forward and back, holding meanwhile inside the bowl a flat piece of charred stick termed the "battledore." This smooths the glass and renders it perfectly circular in shape. Next the punty is removed. and another stem is attached to the bowl portion, as shown in the sketch. The glass is again rotated as before, and the workman now holds against the bottom the flat upper portion of his tongs or "pucellas." This tool is represented separately in the engravings. The effect of this is to smooth the bottom and render it perfectly flat.

When these operations are concluded, a boy seizes the glass in a fork, and carries it to the annealing oven and stands it on the floor. Here the annealing is continued over several hours at a low heat; and as it concludes, the floor of the oven is carried rearward, so that the glass passes into cooler compartments and finally is withdrawn at the rear. Grinding the bottom smooth on a grindstone follows, and any engraving or like ornamentation is done. Nothing then remains except to polish the glass, when it is ready for the market.

When glass is blown, of course no pressing operation comes into use. The blower first gathers the requisite amount of glass on the end of a long tube and rolls it on a smooth polished cast iron slab called a "marver" until it assumes a cylindrical form. Then he blows into the tube, expanding the glass as much as he thinks necessary, and also swinging the tube when he desires to elongate the object; then by means of tongs, scissors, and battledore, he molds it into the desired form. After the shape is once produced, the subsequent operations are similar to those already described.

THE MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

We give below our usual brief abstracts of the principal papers read before the above-named body at its recent meeting in Philadelphia.

General H. L. Abbott gave a synopsis of the results obtained by his observations of the

VIBRATIONS FROM HELL GATE.

The instrument employed at the various stations, for noting the vibrations, was a seismograph, which principally consists of a basin of mercury, giving what is called an horizon of that metal. The agitation of its surface when the vibrations reach it is observed by telescopes with delicate means of measurement. So easily is it disturbed that the footfall of a horse 300 feet away is at once indicated. A number of experiments led to calculation that the explosion on Hallett's Reef, where 3,680 charges were fired simultaneously, ought to be indicated at 59 miles; but General Abbott was very anxious to obtain something more than negative or doubtful results, and hence selected distances not much over 9 and 12 miles. An observation was attempted at West Point, 52 miles away, and no results were obtained. The stations used by General Abbott are all on Long Island; their distances from the reef were very accurately ascertained, and are given in round numbers in the table below:

Stations.	Distance, miles.	Arrival in seconds.	Velocity of transmission in feet per second.
Fresh Pond Junction.......	$5\frac{1}{3}$	63·0	3,873
Jamaica....................	$9\frac{1}{3}$	23·5	4,521
Willett's Point............	$8\frac{1}{3}$	72·3	8,300
Springfield Junction........	$12\frac{3}{4}$	19·0	5,309

The sound, as distinguished from the rumbling of the earth, is described as a dull roar such as comes from a torpedo explosion at a distance. At Springfield Junction, the noise is spoken of as a low, rumbling sound, gradually increasing to a maximum and then dying away.

General Abbott said that he had never seen so quick an explosion. Within half a second of the actual time of firing, the water of the East River thrown up had reached half its hight. During the discussion, Professor O. N. Rood referred to Professor Mayer's experiments at South Orange, N. J., which gave for the vibrations from this explosion a speed of about 3,000 feet per second. Professor Henry mentioned the curious coincidence that the boiler of the Lighthouse Board's steamer sprung a leak at the time of the Hallett's Point explosion; steam had been blown off just previously. It was also mentioned in connection with the theories of vibration that nitroglycerin will tear gun cotton to pieces if exploded upon it; but the cotton does not explode. But if the converse experiment be tried, the explosion of gun cotton sets off the nitroglycerin. Gun cotton will not explode gunpowder.

Professor Loomis discussed

LAST SUMMER'S HOT WEATHER,

and stated that during the whole "heated term," a low barometer was associated with high temperature. On a very hot day, especially selected for observation, the excess of heat was about 20°. Of this about 10° may be fairly attributed to southerly winds bringing hot air from the more heated regions to the south of us. For the other 10°, Professor Loomis proposed to account by the prevalence of extraordinary dryness at the northwest—a region usually dry indeed in summer, but in this instance subjected to unusual drouth, while southerly winds, sweeping over it, kept back the north wind by which it is ordinarily visited at intervals. Here a stratum of heated air was continually formed, which supplied to the general weather of the country 10° of the extra 20°.

THE SUN'S TEMPERATURE.

The actual heat of the sun's surface is one of the unsettled questions of Science, and estimates have varied between 10,000,000°, and 2,700° Fah. Professor S. P. Langley read a paper detailing how he compared the sunlight with that from the molten steel poured out of the Bessemer converter, and thus approximately estimated the solar temperature. A heliostat arrangement was employed to transmit a sunbeam into the foundry of the Edgar Thomson Steel Works, and a Ritchie photometer was used to measure the respective intensities of the lights. The first conclusion reached was that the sun's light, which turns the light from the molten steel into a black spot, must be at least 50 times the greater. Then the spectroscope was employed and the two rays compared. The steel rays were again blotted out. Hence the sun rays must have been at least 64 times bright er. Next, Professor Langley made comparisons of the sun's rays with those from the flames above the converter, when the latter were at their brightest. This was a less difficult proceeding and furnished more specific results. The photometric comparison could be made directly. It is admitted, however, that the flame light may not be quite as bright as that of the molten steel. The arrangement was somewhat like that of a camera obscura. It gave the image of the sun so accurately that sun spots could be easily examined; it also gave an exact representation of the furnace flame. Each was alternately superposed on the other. The conclusion is that the sunlight is at least 2,168 times brighter than the furnace flame. As the heat is presumably of the same relative order, the result is adverse to the law of Dulong and Petit. The actual heat of the sun is probably among the higher values that have been suggested.

Professor Henry's important paper on ocean echoes we reserve for fuller review.

Correspondence.

Centennial Awards.

To the Editor of the Scientific American:

In your issue of October 28, on page 273, are some editorial comments, to which a few additions may usefully be made.

If there are a large number of awards, it must be remembered there are a large number of exhibits; and there may be a few judges or groups of judges that did not fully comprehend their duties, the consequence being that mistakes may have been occasionally made. I know, indeed, that some judges have not recognized the difference between a report and an award, and that awards have been made which are mere copies of the reports by secretaries of groups, who did not quite understand the difference; and the General Board of Judges could not go well behind these awards without the greater chance of injustice to the exhibitors. I fancy, however, that these cases must be very few. I have been a juror in a group that has had almost continuous exercise since the beginning, and considering the novelty of the plan, I am surprised to see how few are the exceptions to its working well.

Your statement of the plan is not quite correct. You say: "The judges simply write reports on exhibits which they deem commendable, and the Centennial Commission thereupon decides which out of the exhibits so reported on are entitled to the medal and diploma." I will not say what some groups of judges may have understood to be their duties; but our group not only reported on those they deemed commendable, but on every person's exhibit. The failure to send in descriptions, to which you refer, made no difference; these requests for descriptions were only to ascertain what the exhibitor claimed. If no description came, the judge used his best judgment. The Centennial Commission did not select, from our report, the awards. We selected them ourselves from our own reports. These have to be confirmed by the Commission. The actual merit of every man's exhibit is the matter of the report; the special merit, the matter of the award. To show you that awards are by no means so freely scattered as you suppose, I will say that, in one particular line of articles, I examined five hundred and twenty-six different exhibits, and have notes of each exhibit on my judge's memorandum book; only forty awards were made.

It is quite possible that some of the judges have not understood their duties under the system, or the system itself; but this should not militate against the whole system, which, from the extended experience I have had of it now, I believe to be the best ever devised, and far superior to the old plan of specified premiums for specified articles, of which, too, in times past, I have had an ample experience.

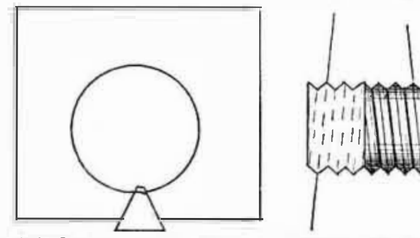
Philadelphia, Pa. ONE OF THE JUDGES.

[For the Scientific American.]

CUTTING A LEFT HAND SCREW WITH A RIGHT HAND TAP.

J. W. S. sends us an interesting letter upon a method of cutting a left hand screw with a right hand tap, which we herewith illustrate. Fig. 1 represents a piece of iron with

Fig. 1. Fig. 2.



the hole (of the size of the bolt to be threaded) drilled in it. A V slot is then cut in it, and a tap ground to an angle with the thread left on the narrow end, which projects into the hole. If, then, the bolt be placed in the hole and the tap in the V slot, and we screw the whole into a vise, with the jaws gripping the back of the tap and the opposite side of the piece of iron, the pressure of the vise will hold the tap and force it to its cut, which is taken by screwing the bolt through the hole in the piece of iron.

The reason why this can be done is as follows: Suppose that Fig 2 represents a piece of iron with a thread cut upon it, and that at one end it is filed down to half its diameter, as shown: it is evident that the side of the thread furthest from the observer stands at an angle slanting from the left to the right, during half its circumference, as denoted by the line, A, shown; so that, if we commence at the bottom and follow the thread for one half a revolution, we shall advance in the direction of A; whereas, if we perform a similar operation, beginning at the bottom on the other side of the thread, we shall, in moving half a revolution, travel in the opposite direction, B: showing that, notwithstanding that the thread advances in one direction, its threads slant in an opposite direction on one half of the circumference as compared to the other.

J. W. S. uses one side of the thread to cut the other with, and thus reverses the angle; and if he will turn to page 21, volume XXXI, SCIENTIFIC AMERICAN, he will find the same principle explained for cutting up inside chasers, in which operation a chaser, to cut a right-handed thread, must, to have the teeth start in the right direction, be cut off a left-handed hub. J. W. S. has, however, given us a new application of the principle. J. R.

New York city.

Watering House Plants.

If the causes of failure where plants are cultivated in windows were minutely investigated, the system of watering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, a good drainage being previously secured, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given keeps the surface of the soil moist; while at the same time, from the effects of the good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for water, and the plant would become sickly and eventually die. In many instances when the contents of flower pots are sprinkled daily with water, the soil in the middle will become hard and dry. When the ball of earth becomes dry, it takes water a long time to penetrate it, and surface waterings do not accomplish the object. In this case set the pot in a pail of water, and let it soak until the earth is thoroughly wetted through. If pro-