organs distinguish between a touch and a blow. The rudest shock or jar does not set the tendril in action, so long as the sensitive cells do not receive a pressure of some continuity, but the most delicate contact of the smallest object will cause stimulation. Thus a bit of spider's thread or the finest silk fiber weighing no more than the fiftieth of a grain will serve to excite curvature. Water, or even as heavy a liquid as mercury, will not cause curvature when poured over a tendril, but if minute particles of chalk are suspended in the water the repeated contact of these bodies will set up a reaction. This is in fact an appreciation of the difference between pure and muddy water, which is probably beyond the capacity of any organ of touch of the human body. After a tendril has grasped a support by means of the above mechanism, the free portion of the organ is thrown into a corkscrew which has the effect of pulling up the stem and anchoring it by an elastic spring.

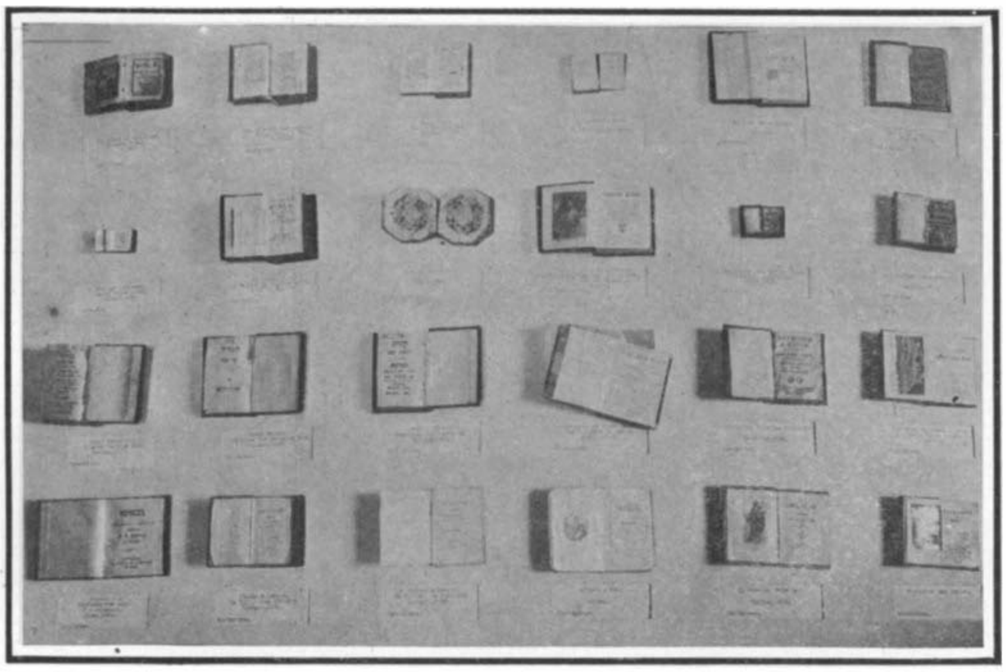
The "sensitive plant" (Mimosa), a small decumbent shrub native to the tropics, offers a striking illustration of another form of sensitiveness to mechanical stimuli, by which shocks and blows, but not contact are appreciated. The base of the leaf-stalk is attached to the stem by a highly developed pulvinus, or motor organ. The slightest shock or jar will cause this motor organ to act, and the leaf is quickly dropped through an arc of ninety degrees. If a stronger stimulus is given, an impression is conveyed up and down the stem to other leaves, and the effect of a single snip of the scissors on a leaflet may be transmitted through a stem a yard in length at a rate of a third of an inch per second, in a manner highly reminiscent of the action of nerves.

The space at command does not allow even a simple description of all of the capacities for adjustment to the external world displayed by plants. In addition to making external responses, or reactions to external forces, a perfect correlation exists between the different organs by which efficient co-operation is secured. Nowhere is this better illustrated than in the common poppy. During the growth of the flower stalk and bud, they are held in the form of a shepherd's crook with the bud pendulous from the tip. When the innumerable divisions and the complicated quadrille of the chromosomes in the ovary of the flower have finally brought the precious egg-cells to a stage where they are ready to receive the chromosomes from the elongating pollen-tubes, the completion or attainment of this stage results in a signal being sent to the curved stalk a few inches away, and it quickly straightens: as the bud expands simultaneously the saucer-shaped flower opens and faces the sky ready to receive the fertilizing pollen. Once this is received the changes ensuing result in sending off a second signal to the motor zone of the stalk and the curvature reforms the shepherd's crook, which holds the capsule pendulous to drop the seeds when mature.

In no instance, however, does the activity of the plant involve choice or decision, or anything except the most generalized form of consciousness. The sensory functions are purely reflexive, and there is no central organ where impressions are received, and from whence signals are sent out, but the percipient organs themselves send impulses direct to the motor tracts.

It is to be seen, therefore, that plants are not degenerates, nor are they lower than animals in any sense: no matter what development they may achieve, or what progress they may make in improvement, they become more widely separated from the animal. Instead of being a lower branch of the phylogenetic tree which has produced animals, they form a separate phylum arising from the common substratum of primitive protoplasm. They constitute a distinct group following a path widely divergent from that of animals, and make the numberless adjustments necessary to their continued existence by a set of sensory faculties wholly characteristic.

During the six hundred thousand centuries that plants have been in existence they have moved unconsciously toward the perfection of a mechanism which receives stimuli, gains impressions, and transmts impulses with a delicacy and accuracy superior to that of the animal in some instances, and fairly commensurate with their needs in all cases.



A COLLECTION OF MINIATURE BOOKS. THE LARGEST IS BUT TWO INCHES IN HEIGHT.

A LIBRARY IN MINIATURE.

Pictured in the accompanying engraving is one of the most important divisions of the Congressional Library at Washington, yet all of the books it contains could be put into a good-sized overcoat pocket. The collection is indeed a library in miniature. The largest book is but two inches in height, while the smallest can actually be placed on a man's thumbnail with room to spare. The piece of cardboard on which the books are fastened is only three feet in length and it contains twenty-four of the tiny volumes. A comparison of the tiniest with the largest book in the collection will give a better idea of the minute size of these works, yet everyone is a complete book in printing and binding. The smallest contains about fifty pages of printed matter, although the characters are so fine that a microscope is required to read them.

MODERN IMPROVEMENTS IN DRYDOCK CONSTRUCTION.

BY H. A. CRAFTS.

Numerous and quite important technical improvements are to be observed in the construction of the modern graving drydock, and these improvements are especially in evidence on the Pacific coast. One of the more difficult problems of operating a drydock is the handling of the bilge blocks, which have to be very nicely adjusted in order to receive any vessel that may be let down upon them. In fact, the master of every vessel that is about to be drydocked is required to furnish the manager of the dock with exact drawings of the outward contour of his hull, in order that the drydock people may be able to adjust both their keelson blocks and bilge blocks so that the vessel may be settled upon them with exactitude in all parts.

Of course, the adjustment of the keelson blocks is a comparatively easy task; because they are all set upon a right line, and only need to be regulated as to their elevations. But it is quite a different thing when it comes to placing a long individual bilge block so that it will receive the weight assigned to it simultaneously and with the same pressure as every other block. There must be both horizontal and vertical adjustment in order that the hull may not be subjected to any degree of wrenching in any of its parts.

But it is in the mode of constructing the bilge ways that the improvements introduced by Mr. Holmes, the chief engineer of the San Francisco Dry Dock Company, are most apparent. The old-fashioned bilgeway, and one still in quite common use, especially in the government drydocks, is raised above the level of the dock floor, and the blocks are confined to the trackage by a system of steel clamps, falling on both sides and catching a piece of armor running along the edge of the way.

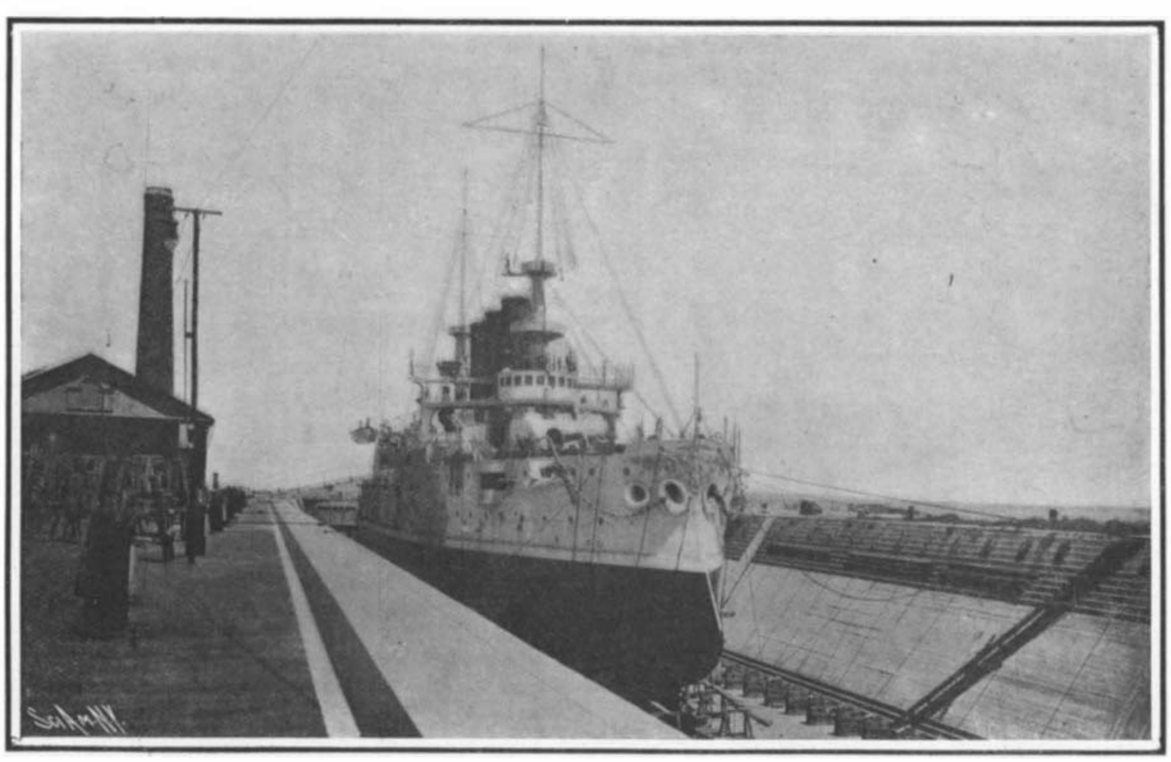
These raised bilgeways are always much in the way in operating a dock; and with a view to doing away with these incumbrances, Mr. Holmes has abolished the raised ways or tracks entirely, and has arranged the bilge blocks to run on a level with the dock floor, being at the same time guided by clamps that drop down into slots let into the dock floor and clutch strips of metal armor with which the slot is edged, very much after the fashion of the slot in the cable street railroad.

Thus the dock floor is left perfectly free and open, while at the same time the bilge blocks may be run back and forth just as well as if they were operated upon raised ways.

Both lines of bilge blocks are arranged so that they can be operated from one side of the dock, whereas it used to be the custom, and the custom is to some degree extant to-day, to operate each line of blocks independently from its own side of the dock. By the new plan, a pair of companion blocks, that is, a block and its opposite, may be operated by one man and from one side of the dock, and the thing is done by means of a combination of lead lines and hoist blocks. By pulling one pair of lead lines the bilge blocks are made to approach each other, and by pulling another pair they are made to recede from each other. An improvement has also been made in the method of drainage. The floors of the government drydocks are drained by a system of small sewers, and much trouble is experienced by these sewers becoming clogged. The new method does away with sewers entirely, and drains the dock floor from the surface. Drainage is effected from each end of the dock to the center, and into the main sump or pump pit, by a system of open gutters, the gutters being 2½ inches wide and 6 inches deep. By this means the floors can be cleaned by the use of a common "squeegee," or rubber-armed scraper, into the gutters and then flushed with a hose. Likewise the gutters, being open, may be easily cleaned out should they become clogged or foul.

Another innovation concerns the method of cleaning the gate seat. Of course, it will be understood that it is necessary for the caisson of a drydock to fit into the gate seat perfectly, otherwise there will be a leakage so soon as the dock is pumped out.

In order to clean the gate seat, Mr. Holmes has devised a new method. A system of water pipes built into the masonry of the gate seat discharges upon the seat. These pipes are connected with the donkey engine of the dock, and powerful jets of water are projected through them upon the gate seat.



U. S. S. "OHIO" IN THE SAN FRANCISCO DOCK.