between the cable sections and the mains were protected by iron sleeves locked in place by setscrews, after which the sleeves were filled with an insulating substance. These operations, requiring a great amount of attention and accuracy, were carried on under a tent to guard against moisture and other disturbing factors.

As a perfect insulation of the cable is of vital importance in this work, each of the sections buried in the trenches was immediately submitted to certain tests. The apparatus for this purpose was arranged in a special cable-measuring car, which was conveyed by hand along the cable line, and by means of which the necessary observations were carried on in a minimum of time. To provide for future measurements of the voltage, etc., obtaining at the terminals of the cable, each conductor is provided with a testing wire, the diameter of which is obviously quite small. In one of our illustrations the three testing wires may readily be seen beside the main conductors. At the crossing of the cable line with the Goerlitz Railway, iron pipes receiving the cables were fitted at a depth of three feet below the ties. Seven such cables were laid during last summer, following a common course as far as Vienna bridge, whence they branched off in three strands to the Zossenerstrasse sub-station, and in four strands to the Alte Jakobstrasse sub-station.

MAKING THE FLAGS OF OUR WARSHIPS.

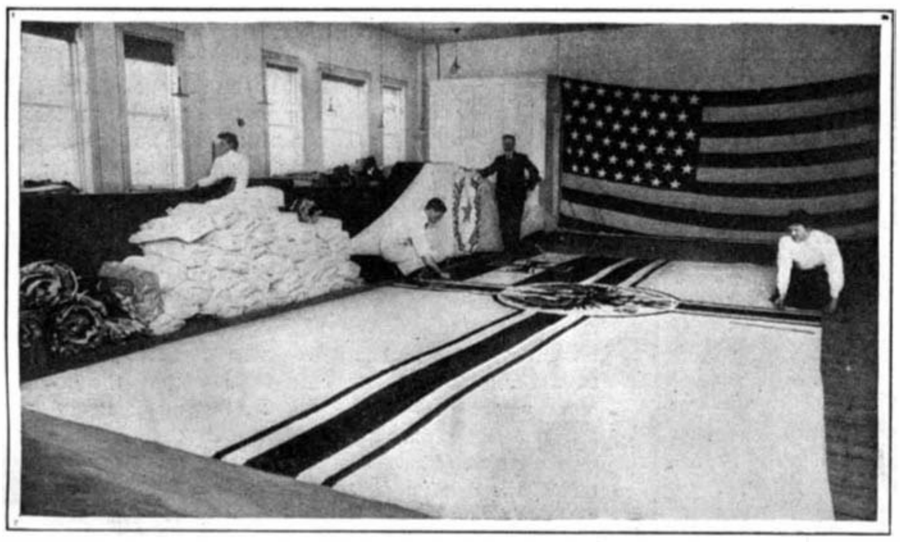
BY WALTER L. BEASLEY.

Through the courtesy of the Commandant of the Brooklyn navy yard and Commander A. Ward, chief equipment officer, the writer was given special opportunities for obtaining a full series of pictures showing an interesting and comparatively little-known department in which the flags of our warships are made. The flag room is under the supervision of Mr. Thomas Malloy, officially rated as master flag-maker, and Miss M. A. Woods, quarter-woman flag-maker. Mr. Malloy favored the writer with all the main details of the flag department, which are outlined in the present narrative.

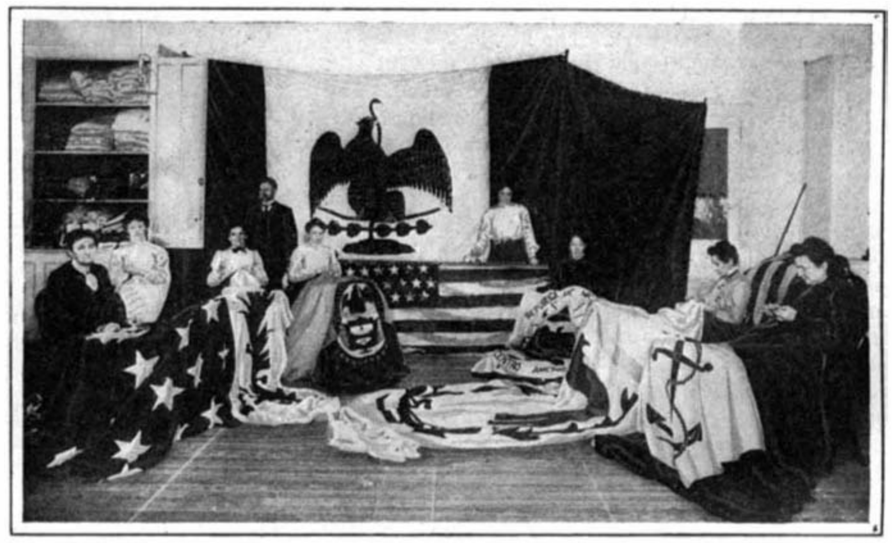
To furnish the many hundreds of naval vessels in commission, ranging from the large flagship and battleships and the numerous smaller class, with their regular quota of flags, the government is required to maintain an extensive plant. Few, however, realize the number of flags carried by a warship, nor the cost of all the gay bunting which flutters from mast to mast at holiday time. In addition to fleet communication, necessary during all forms of maneuvers in home waters, the ship must be equipped with an extensive array of flags stored on board for various forms of ceremonial and official occasions. This "dress suit" outfit of bunting, therefore, consists of 250 different flags, the material and making of which costs Uncle Sam just $2,500. Each ship is entitled to a new flag equipment every three years, though a flagship will often require a new set of signals, owing to their constant use and handling, in about a year.

A striking idea of the number of flags carried by a single ship may be gleaned from one of the accompanying illustrations, showing a pile 15 feet long and nearly waist high, just finished for the new battleship "Connecticut." About one-half of the lot is composed of foreign flags, incased in thick paper bags, with the name of the country stenciled on the bottom. The remainder, including those for ordinary use, signal sets, and the international code, etc., are not wrapped, but merely tied in round bundles. Last year for operating the flag factory the government expended $60,000; $43,000 of this amount was for material alone. This, however, includes a small sum for table linen and curtain fixtures; the labor amounted to $17,000. The number of flags turned out was over 59,000. In all, 408 distinctive kinds were made. To cut out the varied patterns and complete all these miscellaneous flags, some thirty-five skilled machine sewers and needle-women and three men are employed.

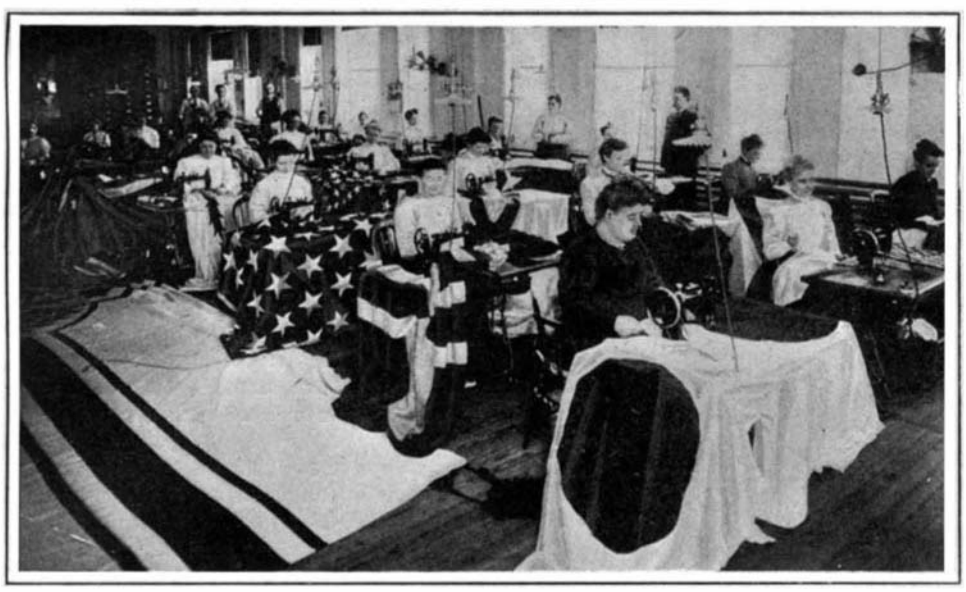
With the bright-colored, fantastic flags of all nations dangling from their machines, the long row of flag



Finishing the German Ensign, the Most Expensive One Made.



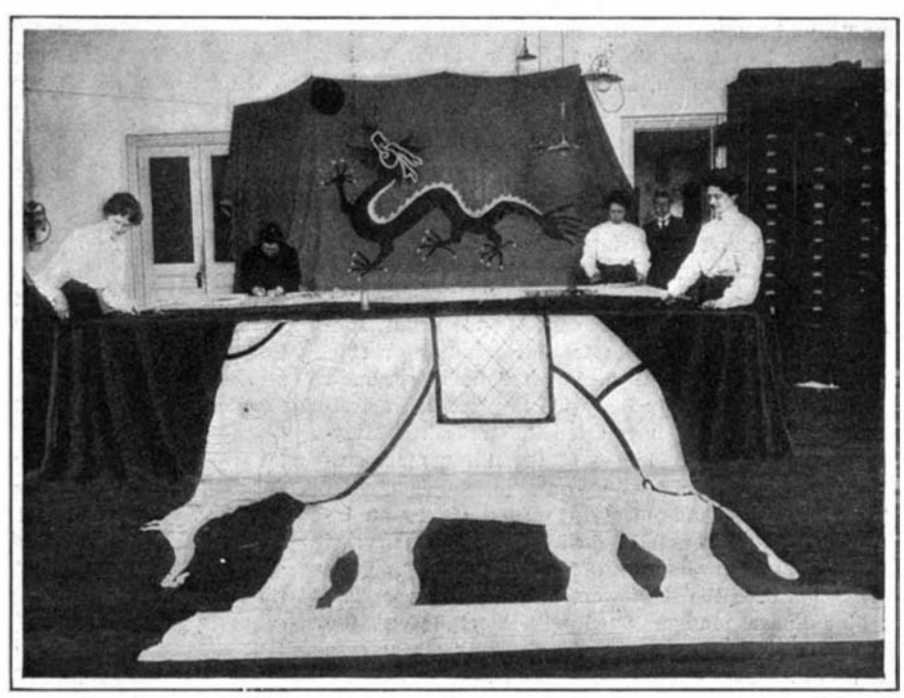
The Hand Sewers Who Execute the More Difficult Designs.



One of the Main Rooms of the United States Flag Factory at the Brooklyn Navy Yard.

The Star Cutting Machine; Sewing On a Halyard Bend.

The Flag Outfit for the U. S. S. "Connecticut," 250 Flags Costing $2,500.



Cutting Out Patterns; the Flags of China and Siam Above and Below the Table.

MAKING THE FLAGS OF OUR WARSHIPS.

makers present a picturesque scene. The long spacious room is literally a blaze of color. Rolls of bright bunting are heaped up waiting to be cut, while long lines of women operators are swiftly sewing the seams and putting the finishing touches to American and to forty-three foreign ensigns of different hues and patterns. The flags are cut out from measurements arranged on chalk lines and metal markers on the floor. Large stripes and certain designs can be more conveniently stitched in this way. Daily a section of the floor is covered at all hours with several different flags, with the men and women cutters at work. The final sewing is done on machines by the women. Each machine is run by a small electric motor of one-fourth horse-power. Owing to long service, the labor has become highly specialized, and the women are kept at work on the particular flags which they can make the best. Some excel in sewing on the stars, others in finishing certain other parts of the flag. Nearly all have been in the establishment for years. Their pay averages from $1.20 to $2 per day.

A great deal more time and labor is required to finish certain of these flags than is generally supposed. For instance, the President's flag requires the longest time of any to make, as it takes one woman a whole month to complete it. The flag consists of a blue ground with the coat of arms of the United States in the center. The life-sized eagle, with long outstretched wings, and other emblems, are all hand-sewed and involve the most patient work. The flag is made in two sizes, 10 feet by 14 feet and 3 feet by 5 feet. The silk used on this and other designs costs $9 a pound. The largest flag made is the United States ensign No. 1, 36 feet long by 19 feet wide, which costs $40.

The most difficult, expensive, and likewise consuming the longest time to make, are the foreign flags. This is especially true of the South American and certain others. These in most cases average 5 feet in diameter. The work is done by a half-dozen specially skilled hand device sewers, each having acquired the knack of making certain of the center designs to perfection, and continually kept on these respective flags. Every battleship carries forty-three foreign flags, 25 feet by 13 wide. A smaller size is also made. The weakest in point of power and smallest of the Latin nations have the most gorgeous and picture-bedecked ensigns. That of San Salvador is especially so, and requires much time and patient labor to complete. The half-tone representation of this hardly brings out the wealth of detail and elaborate sewing that is expended on it. For a center piece the San Salvador has a regular marine landscape, consisting of a belching volcano and a rising sun, set in a varied design of draped banners, cactus branches, cornucopias, and a swastika on the ground of a rayed diamond, with the date of the independence of the nation inscribed on the top. One hundred different pieces are used to form the center design. It takes one woman sixteen days to complete the San Salvador ensign, which costs $52.50. The most expensive ensign to make is the German, which, owing to the delicate scroll work of the large imperial eagle and royal crown, necessitating delicate, slow, and careful sewing, costs $56.50. The dragon flag of China consists of two hundred separate pieces. Twelve to fourteen days are ordinarily consumed in finishing this flag, which costs $51.75. The flag of Siam with the huge white elephant costs $38. The Mexican, with its center design of a large eagle holding a serpent in its bill, cost $39.50. The cheapest foreign flag made is the Moorish, which costs $21.

Last year 150,000 yards of bunting were used. This is all wool, 19 inches wide. Samples of English and Italian bunting have been tested in the past to compare with the American. The former lacked in tensile strength and was over-weight, and the red lost considerable color in the washing tests. The Italian filling was not up to standard, and likewise lost color. The warp and filling of the navy bunting now used has thirty-four threads to the inch, and is of light weight—a very desirable feature. The material is given both a chemical and physical test. For the former several strips are cut from a bolt, which are soaked and washed in soap and fresh water for twenty-four hours. The next day the same process is followed, using salt water. They are then exposed to the weather for ten days, thirty hours of which must be in the bright sunlight. This is for the color test. No fading or running of colors is tolerated. For tensile strength, a strip of the warp two inches wide is placed in a testing machine, and must have a tensile strength of sixty-five pounds, while two inches of the filling must sustain a forty-five-pound test.

The many thousands of stars are cut out by an ingenious machine, specially devised for this purpose, operated by a four-horse-power electric motor. Only a few years back the stars were cut out by hand. The machine has a plunger fitted with steel knives, the shape and size of the star. A single down stroke cuts out from fifty to one hundred at a time.

Pressing the foot on a pedal operates the machine. In all, eight different sizes of stars are used, each having a special die. Running the machine for only an hour a day furnishes enough stars to keep the women operators going for several days. The stars vary from fourteen inches in diameter to less than two. All completed flags are pressed by an electric ironer. A heading of flax raven canvas is sewed on, together with a distance lining of plaited hemp rope. This fiber will not kink or twist, and is specially made for flag purposes on board the naval prison ship at Boston. Wooden toggles for catching the loop are also put on, and the border stamped with the name of the flag and date of contract. After being critically inspected and passed by Master Flag-maker Malloy, the flags are delivered to the general storekeeper in the yard, where they are held until needed by commissioned ships.

HOW GLACIERS ARE STUDIED.

BY CHARLES WILES.

Despite the interest that has been taken especially in recent years in the study of glaciology, the thickness of but one of the world's glaciers has been accurately determined. This is one of the ice formations in the Tyrol, which has been pierced by the tedious process of hand drilling, and its depth from the formation on which it rests to the surface of the ice ascertained to be a little over 400 feet. The thickness of the great Piedmont glaciers, such as the Malaspina and Miles, and the Alpine glaciers in the Cascades of the United States and the Selkirks in British Columbia, have only been estimated by those who have made a study of them.

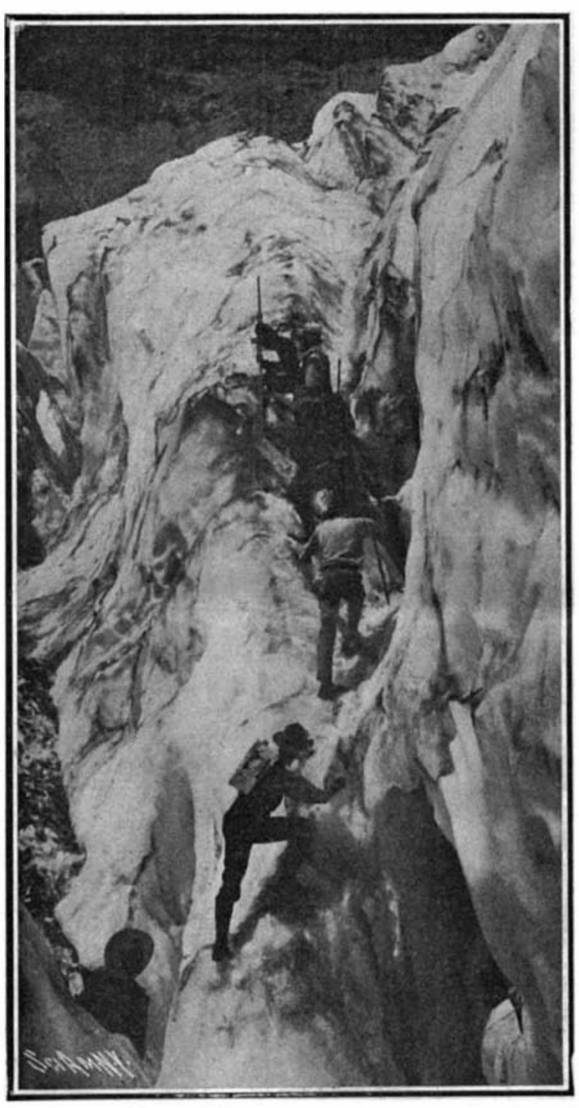


Photo. by A. Curtis.

A Hard Climb.

HOW GLACIERS ARE EXPLORED.

While scientific observation on other lines has been materially aided by funds advanced by institutions and individuals, glacial study in America has not had the support its importance merits, and much of the data we have of the great ice masses lying on the coast and mountain slopes of western America is due to the efforts of a few investigators, who in some instances have taken up the work unaided financially. Thus it happens that the surface dimensions and glacial flow or movement have embraced most of the information with which we are familiar. For example, the Nisqually, one of the largest on Mount Tacoma or Rainier, has been calculated to be at least 500 feet thick near its lower edge. A study of the ice wall at the point where it terminates in the Nisqually Valley would indicate that these figures are not exaggerated, and that the slope of the valley which is covered by the glacier may be more abrupt than is generally supposed. Should this be the case, the thickness at the bottom may be much more than the estimate given.

This lack of data in connection with glaciology is more noticeable for the reason that the glaciers, not only in the Alps but in the western portion of the United States and in British Columbia, have been the subject of careful study. The notable group on Mount Tacoma (Rainier) has formed an attractive series for scientists. As far back as 1857 at least one of the formations on Tacoma was known, but no authentic information was obtained until investigated by Prof. E. S. Emmons in 1870. In 1905 Prof. Le Conte, of the University of California, ascended the mountain, and with his associates devoted considerable time to a careful survey of the Nisqually glacier. The results of the investigation of this party proved of much value in adding to information on the subject, although, as stated, no measurements of the thickness of the ice could be secured except figures based on general estimates. The surface of the Nisqually was measured by the use of such well-known instruments as the theodolite, and its width and length accurately noted for what was probably the first time.

The movement of this glacier has been the subject of much attention among scientists, who have visited Mount Tacoma, on account of its shape and location. Lying in a valley inclosed by walls of lava formation, the glacier apparently has cut its way through the volcanic rock on which it originally rested, for the walls on either side rise above the ice surface to a height ranging between 1,000 and 1,500 feet. The incline of the glacier downward is at a very steep angle for the greater portion of its length. In fact, the head of this great river of ice in places is almost a vertical wall. Consequently, the downward pressure is enormous. In summer, when the lower portion disintegrates more rapidly on account of the rise in temperature, the fissures or crevasses in the surface are much more numerous. The movement of the ice mass in connection with the moraines is of such extent, that one can distinctly hear the sound produced by the cracking and grinding of the ice at a distance of a half mile from the gorge in which it lies. That the Nisqually is one of the most active glaciers in North America is shown by the fact that in a single day the lower portion has moved twenty-two inches. One of the most rapidly-moving glaciers thus far measured is the Mer de Glace in Switzerland, which has a record of thirty-five and one-half inches in twenty-four hours. Needless to say that the movement varies considerably, depending much upon the time of the year, as well as the bed on which the glacier rests. Should the formation change in character by the erosion of the ice, and the latter encounter a soft rock stratum, its downward movement may increase considerably, owing to the decrease in resistance to it. The width of the Nisqually from edge to edge is nearly 1,500 feet; its depth has been estimated at 500 feet. The crushing force of such a mass can only be imagined. Looking down into the abyss in which the glacier lies, the Niagara gorge seems of insignificant proportions in comparison.

The Nisqually is one of four large glaciers which form the upper ice cap of Mount Tacoma—a cap of such dimensions that at a distance of sixty miles the top of the mountain appears to be entirely covered with it. Like the Nisqually, each of the others forms the source of one of the most important rivers of the Northwest, this single mountain giving birth to the Nisqually, the Cowlitz, the Puyallup, and the White rivers. Including the smaller ice fields, Mount Tacoma contains no less than sixteen glaciers. Consequently it affords in itself a broad field for the study of glaciology.

As has already been stated, the surface of glaciers is measured by some of the methods usually employed in civil engineering. To ascertain the movement, however, a somewhat novel plan has been adopted in connection with the Tacoma glacier. Selecting suitable spots on the surface, holes are cut in the ice into which stakes are firmly driven. Care is taken, however, to set the stakes in a straight line at right angles with the length of the glacier. The stakes are placed at nearly equal distances apart, the line extending a considerable distance across the surface. Other stakes or base marks are made on the bank at the side of the glacier. The change in the position of the stakes after they have been driven aids in determining the glacial movement, for they not only show the total extent to which the ice mass has worked its way downward, but the more rapid movement of some portions than others, as the line of stakes is so irregular. For example, the stakes in the center may be considerably in front of those at the side, indicating that here the downward and forward pressure is greatest. Another method of ascertaining the movement is to substitute cairns of stone for the stakes, locating them with special relation to "monuments" on the bank, so that the movement can be gaged by their position after being erected.

Prof. Le Conte's party had a special opportunity to observe the extent of the crevasses in the Nisqually as well as the Cowlitz glaciers, since their investigations extended beyond the *névés* in each case. The trip up the mountain was made from Reese's camp in the Paradise Valley, which is bounded on one side by the Nisqually gorge. One of the principal routes taken in reaching the summit is up the head of this valley, skirting the precipices known as Mc-