the world over. As compared with the square-rigged vessels of the schooner, brig, brigantine, or bark type, the American fore-and-after has the advantage of being a better craft when sailing close-hauled and of requiring fewer men to man it. In an earlier day of the development of our merchant marine in the coasting trade, the two-masted schooner was the common type; then came the three-masted schooner, and this was followed by vessels of four, five, six, and now seven masts. The carrying capacity of these schooners, the largest of which are engaged almost entirely in the coal-carrying trade, is exceedingly large. Thus, the five-masted schooner constructed at Camden, Me., in 1899, is 318 feet in length, 44 feet beam, and 21½ feet in depth. The vessel will carry 4,000 tons of coal on her maximum draft. Work on this vessel had scarcely been completed before Capt. Crowley, of Taunton, Mass., had given orders for the construction of a six-masted schooner. This vessel is 330 feet in length, 48 feet in beam, and has 22 feet depth of hold. On her maximum draft of 24 feet she will carry 5,500 tons of cargo. Her lower masts are each 116 feet in length, and her topmasts 58 feet.

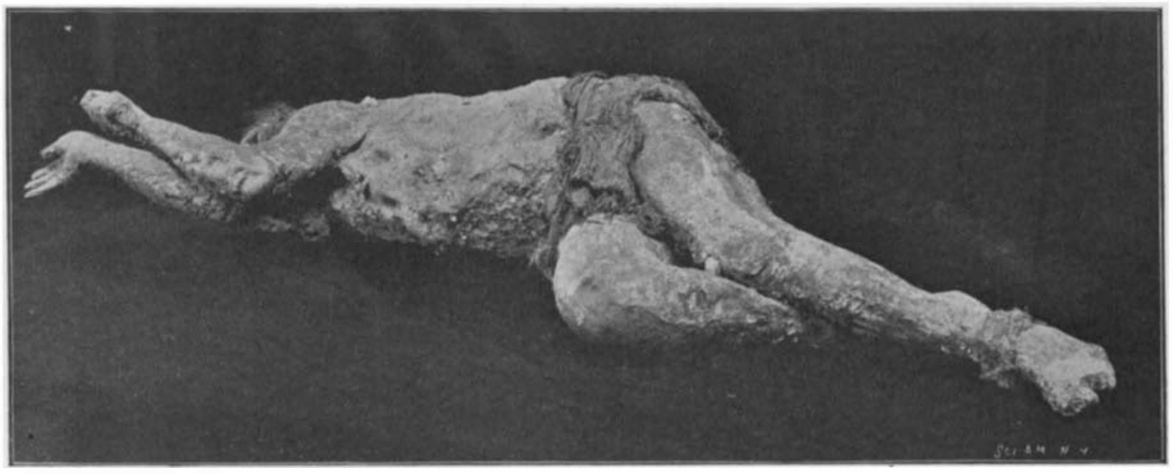
The latest of these giant schooners is the great seven-masted vessel shown in our accompanying illustration. It has been built from designs by B. B. Crowninshield, of Boston, the designer of many small and very successful racing craft, and of the 90-footer "Independence." Unlike her predecessors, the new schooner is to be constructed throughout of steel. There will be a bar keel of forged steel 3½ inches in width by 12 inches in depth, which will extend from stem to sternpost. There will be a cellular double bottom with a continuous, single, vertical, keel plate weighing 22.5 pounds to the square foot. The upper bilge-strakes will be of 28¾-pound plate for two-thirds of the length. The middle bilge-strakes will be 30 pounds weight for the same distance and the lower bilge-strakes 25 pounds. The bottom strake will be 20-pound plate, while the garboard strake will be 29-pound plate for two-thirds of the length. All of the plating reduces to 18¾ pounds at the ends of the vessel, except in the case of the garboard strake, which will reduce to 25 pounds at the ends. There are three complete decks, which will be of steel plating, the upper deck, forecastle and poop-deck being wood-covered. A collision bulkhead will be worked in at a suitable distance from the stem.

The lower masts throughout the vessel will be built of steel, with lapped edges, flush butts, and stiffening angles extending inside for the full length. The plates will be single-riveted at the edges and double-riveted at the butts. The plating will be double at the mast partners and at the hounds. The masts are all 135 feet in length from the mast step to the top of the upper band, and they have a uniform diameter throughout of 32 inches. The topmasts will be of Oregon pine. They will be 58 feet in length over all, tapering from 18 inches in diameter to 10 inches, except the foremast, which will be 64 feet in length and 20 inches at its point of greatest diameter. The booms of the first five masts will be 45 feet in length by 14 inches in diameter, the spanker boom being 75 feet in length by 18 inches in diameter. The total sail area of the lower sails and topsails will be 40,617 square feet. All of the standing rigging, and in special cases the running rigging for the lower sails, will be of a high quality of wire rope. Although this vessel is to be propelled entirely by sails, she will carry quite a considerable installment of machinery, including one 9-inch by 10-inch Hyde double-cylinder ship engine, and five 6-inch by 8-inch Hyde hoisting engines. There will be two vertical boilers 56 inches in diameter by 90 inches high, one in the forward house and one in the after house. The boilers will be built for a working pressure of 100 pounds to the square inch. There will be two 8-inch by 4-inch by 6-inch duplex pumps and two direct-acting steam pumps, with steam and water cylinder, each 12 inches in diameter by 12 inches stroke. As the result of the installation of steam power on board for the purpose of hoisting anchors and sails the number of hands necessary to work this large vessel is considerably reduced, the total number required being only nineteen men. The total cost of the vessel delivered will be about $250,000.

We are informed by Mr. Frank N. Tandy, of Boston, who was recently associated with Mr. Crowninshield, that so great is the confidence in the success of this vessel that preliminary steps are being taken by him and others toward the construction of a second seven-masted schooner.

A CURIOUS EXAMPLE OF PETRIFACTION.

In the Chilean Department at the Pan-American Exposition there is on view the semi-fossilized remains of an Indian woman. The specimen has just been submitted to examination by Dr. John A. Miller, who states that it is the body of an Indian woman, supposed to be about five hundred years old. She was found buried in an old copper mine in the Andes, near Colama, which was a part of the territory subjugated by Pizarro and taken from Peru by Chile. It is supposed that while working with stone implements used for extracting copper there was a cave-in which caused the death of the woman. Being at an altitude of 11,000 feet, the rarefied atmosphere and the dryness of the mine, combined with the peculiar metallic qualities of the earth about her, served to preserve the body as it is seen to-day. It weighs less than fifty pounds and is in a half-mummified, half-fossilized condition. There are small stones embedded in the flesh at many points, and the blood which was forced from the ears is still to be seen in the matted hair, which has kept its dark reddish-black color. Several portions of the body are crushed, including the shoulder, the chest and the lower limbs. Around the hips is a cloth of ancient weave, and the tools used and found with the remains make it possible that she was a miner in the realm of the Incas. The sledge-hammer and other hammers are most interesting, as they are still attached by strips of hide to their handles, which are pieces of wood bent in the middle. The stone is placed in the joint, so that both ends were grasped, one in each hand.



PETRIFIED PERUVIAN INDIAN WOMAN EXHIBITED AT THE PAN-AMERICAN EXPOSITION.

The discovery was made in a mine which was opened to take out small pieces of ore. The body was covered by about seven feet of loose earth.

PHOTOGRAPHING THE ELECTRIC ARC.

BY PROF. A. C. SCOTT.

The purpose of this article is to notice briefly some points concerning arc light carbons in operation, as indicated by direct photographs of the arc itself.

It is conceded that the classic demonstration in the Royal Institution of Great Britain in 1810, by Sir Humphry Davy, when the voltaic arc was first exhibited, presented the beginning of a world-famed era in artificial illumination. It needs but a glance at the history of artificial lighting to see that some of the greatest minds have been concerned in the final production of that most powerful of artificial illuminants, the electric arc. Though progress in its development was slowly going on during the first half of the century, the last three decades have witnessed by far the most phenomenal results, such results being made possible only after Gramme had, in 1870, opened the way by the invention of the dynamo-electric machine.

Attention is frequently called to the almost innumerable devices and improvements used upon the arc light, along the lines of controlling mechanisms for various purposes, with lamps used on both continuous and alternating-current systems, together with discussions on the substitution of the modern inclosed arc for the open arc, and allied subjects. The question of the carbons, however, does not, and at present need not, receive quite so much attention.

For our purpose it is necessary to consider for a moment a bit of the history in arc light carbon production. The water-quenched charcoal pencils employed by Davy had soon to give way to a harder form of carbon, in order to obtain even moderately satisfactory results with the arc. Gas-retort carbon was subsequently used for some years, and though it was sufficiently hard, it contained impurities, of which silica was a very important one. The effect of such impurities was to produce a constant hissing, and frequent blowouts as well. It is evidently with this class of carbons that the illustrations of the arc so frequently seen in textbooks of physics and electricity have been made. It may be more accurate to say that drawings made of the arc, when carbons containing large quantities of impurities were in use, have been copied and recopied from an early date in the history of the arc down to the present time. One of the commonest of these representations seems to have been handed down from an early drawing, and is shown in Fig. 1. It exhibits a number of globules or wart-like forms of matter on the negative carbon, which are very large in comparison with the carbon pencil itself. It does not seem just to doubt the correctness of this representation,

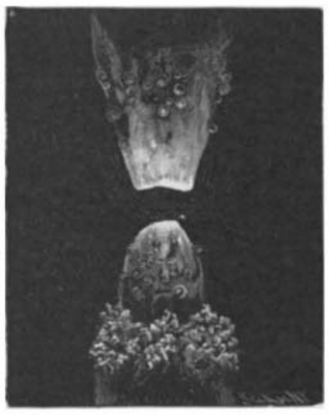
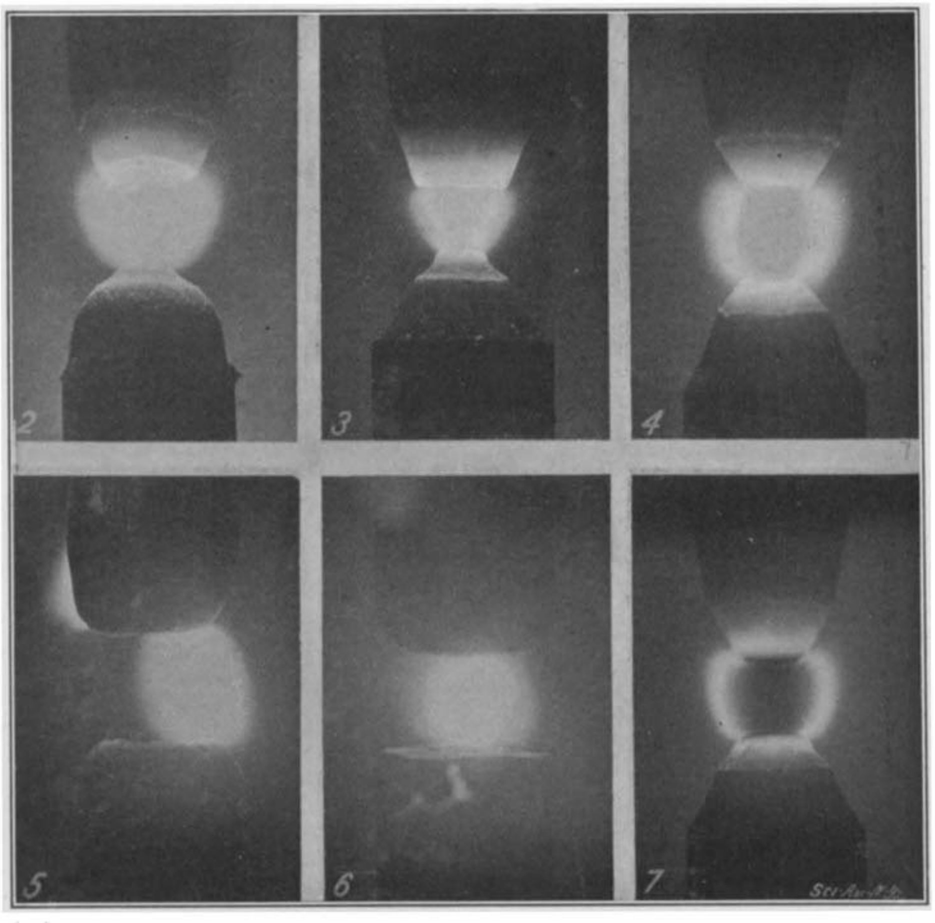


Fig. 1.



1. Conventional picture of the arc. 2. Continuous current open arc after burning seventy minutes. 3. The same after burning two hours. 4. Alternating current arc after burning two hours. 5. and 6. Inclosed arcs. 7. From reversed negative.

PHOTOGRAPHING THE ELECTRIC ARC UNDER VARIOUS CONDITIONS.