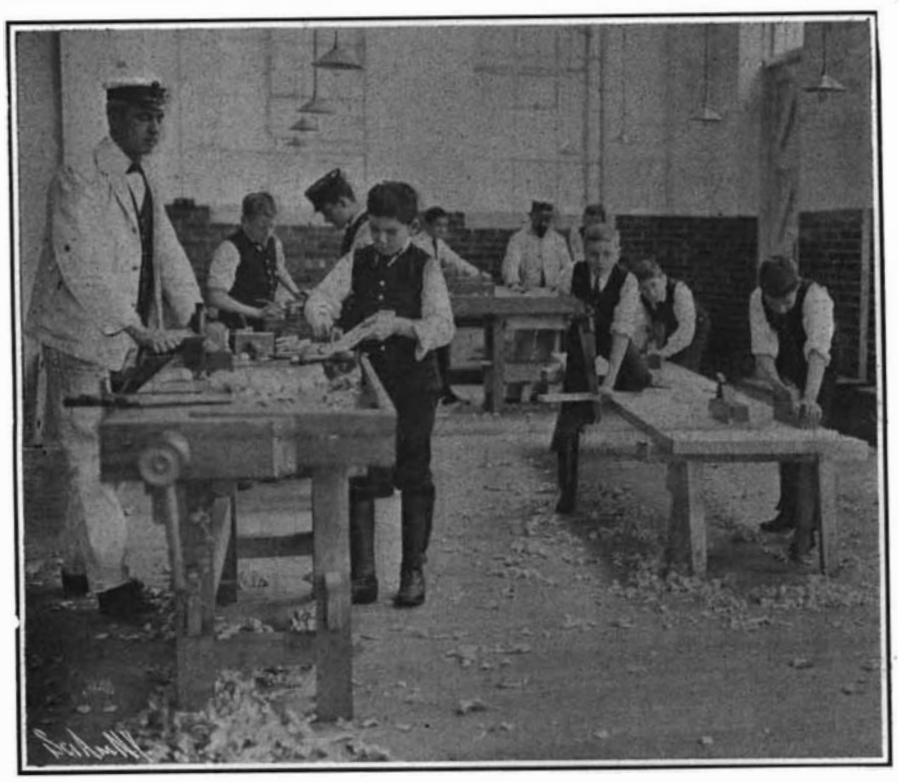
OSBORNE COLLEGE: AN ENGLISH NAVAL SCHOOL.

BY HENRY HALE.

The British methods of recruiting and educating young men who are to officer the ships of the several fleets is quite different from the American method. While in the United States the education of the naval officer is centralized, so to speak, at Annapolis, one finds institutions for the training of cadets at different points in Great Britain, as well as several station ships which are intended exclusively for instruction of this sort. The boy who enters the Naval Academy at Annapolis not only secures a knowledge of the ordi-

The Cadets of Osborne College.



A Lesson in Carpentry.

The Chemical Laboratory at Osborne College.

The Parade Ground of Osborne College.

nary duties of a sailor and ship's officer, but also receives a thorough military training as well, being required to handle field artillery; in fact, becoming proficient in all of the branches of the land service with the exception of the cavalry. It may be needless to say that the present routine at the Academy includes his instruction not only in navigation and other branches of seamanship, but before making his first cruise on any of the practice vessels he has become versed in naval construction as well as steam engineering.

The British midshipman, however, usually enters one of two courses, which fit him for an engineer officer or an executive officer, the older cadets being divided into these two classes, and following the system which prevailed until recently in the United States navy. The cadets intended for executive officers secure entrance usually through the Admiralty Office, those who pass the examination go to the new college, also the ship situated at Dartmouth. Their studies are quite similar to the curriculum at Annapolis, the life on shipboard being relieved by short practice cruises both in steamers and sailing vessels. At the end of fifteen months they are supposed to graduate as sea-going cadets, and are then assigned to warships, to serve three and one-half years as acting sub-lieutenants. A course of six months at Greenwich is supposed to complete their education, with the exception of instruction in ordnance. They then receive their commissions as sub-lieutenants, and become naval officers in reality. The cadet engineers, however, receive most of their instruction at Keyham in Devonport, where they remain about four years before going to sea.

One of the most interesting institutions connected is seamanship, especially the handling of sails and yards, the splicing and knotting of ropes, and other work which pertains to the sailing vessel exclusively. Thus the classes who graduate from Osborne College secure not only a knowledge of mechanics and engineering, but the construction and equipment of the sailing vessel, whether it be a full-rigged ship or a one-masted sloop.

Osborne College is one of the latest institutions for naval instruction. It may be termed a preliminary school, since the majority of those who graduate from it enter the higher institutions to complete their education, whether intended for engineers or for executive officers. As a preparatory school the college has already proved itself a most valuable addition to the system provided by the government to equip officers for its navy.

Increasing the Efficiency of Boilers.

Experiments now being conducted by the boiler division of the United States Geological Survey fuel-testing plant at St. Louis, Mo., on the nature of boiler efficiencies have suggested that stationary boilers ought to be made to do ten to twenty times as much work per unit of heating surface as they do now.

This great increase in capacity is to be attained by subdividing the heating surface and water streams more finely, by allowing less restriction of the water inside the boilers, and by using high forced and induced draft to put a large mass of gases through the boiler at a very high speed.

Up to the present time there have been only vague ideas among engineers as to what factors influenced the efficiency of the steam boiler portion of the steam generator apparatus, so as to cause it to absorb more or less of the heat generated by the combustion. Mr. John Perry, a distinguished mechanical and electrical engineer of England, went into the subject mathematically a few years ago, and set forth general conclusions tentatively in his book on the "Steam Engine and Gas and Oil Engines."

About a year ago, the government testing plant took up the mathematical investigation of the theory of the steam boiler and of heat absorption, and extended Mr. Perry's theory somewhat. For some weeks past Mr. Walter T. Ray, assistant engineer, acting under the supervision of Prof. L. P. Breckenridge, engineer in charge of the boiler division, has been conducting a series of experiments on small multitubular boilers, dimensioned as to enable the theory to be verified, or modified, or refuted. The boilers are fed with air heated electrically. Mr. Perry's theory states that modifying conditions being omitted from consideration, every boiler will always absorb by convection, from the gases passing through it, the same percentage of heat which could possibly be absorbed by any boiler containing water at a given steam temperature. This efficiency is, therefore, independent of the temperature of the entering gases and of the amount of gases flowing through the boiler. Of course, it must be understood that the above statement of the theory is slightly subject to modification even theoretically, and more so in practice.

As a practical example, assume that the water in a boiler circulates with entire freedom, which is an unwarranted assumption, and that its temperature is 300 deg. F.; let the gases enter the boiler at 1,300 deg. F.; then the difference between the two is 1,000 deg. F., and consequently it would be possible for a boiler infinitely long to reduce the temperature of the gases passing through it to 300 deg. F. Let us assume, however, that the gases leave the boiler at 500 deg. F., which is 200 deg. above steam temperature. The efficiency of the boiler then is 80 per cent, because it has reduced the temperature 800 deg. out of a possible reduction of 1,000 deg.

If the same boiler be supplied with gases at 2,300 deg. F., the gases enter the boiler at 2,000 deg. F. above steam temperature. Mr. Perry's theory states that this particular boiler will reduce these gases 80 per cent as much in temperature as would a boiler infinitely long; that is, to 400 deg. above steam temperature, which is 20 per cent of 2,000 deg., or to 700 deg. F. It will be noticed that the mass of gases does not enter into consideration at all.

This surprising deduction is being accurately verified by the afore-mentioned division of the Survey, from which it is found, when keeping other conditions the same and when keeping the initial temperature of the gases constant, that the final temperature of the air remains the same, whatever the amount of air sent through the boiler per second. So far, the upper limit has not been reached with tubes clean inside and out, although the rate of evaporation has already been pushed up to many times that obtained even in locomotive practice.

Perry's theory takes into consideration four fundamental features affecting heat absorption at any point of the heating surface:

First: Temperature difference between the gases outside any portion of the boiler tube and the water inside.

Second: The number of molecules per cubic inch in the gases outside the boiler tube.

Third: The specific heat of the gases at constant pressure.

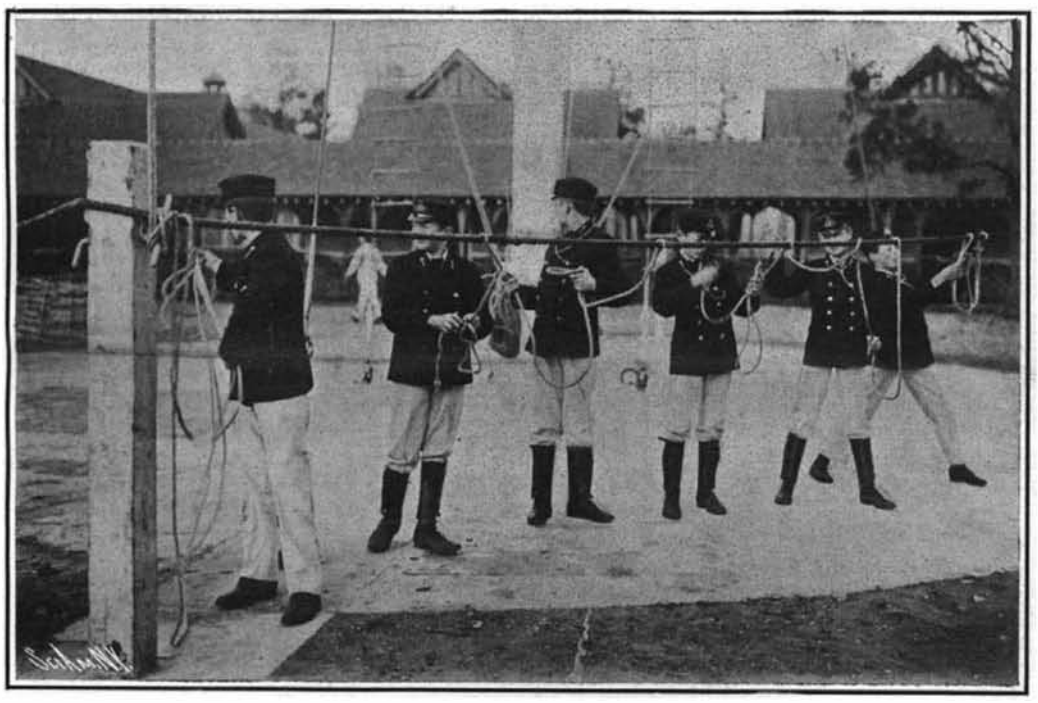
Fourth: The velocity of the gases parallel to the heating surface.

Of the four above factors, only the first has usually been considered. It will be readily seen that if we increase the temperature of the gases, we decrease the number of molecules beating against any square inch of tube heating surface, and thus the second factor largely neutralizes the first, especially at high furnace temperatures.

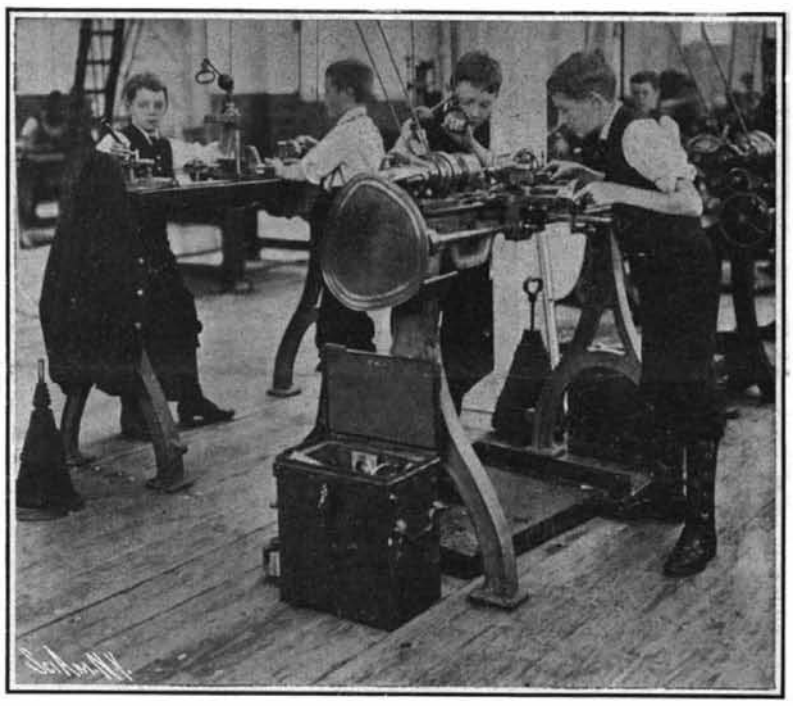
The third factor can be taken as constant, equal to 0.24.

The fourth factor is the new and surprising one. Mr. Perry considers that a high velocity of gases parallel to the heating surface scrubs off more or less of the dense film of gases adhering to the metal surface, which film of gases has already become cold by proximity to the metal. The higher the velocity of gases the more the scrubbing effect, and consequently the greater the amount of heat transmitted. This theory necessarily assumes that the ability of the metal to transmit heat is practically infinite; and when we consider that we ordinarily never put through a boiler tube more than 1/1000 of the heat that it could possibly carry, it will be realized that this assumption is warranted.

Mr. Perry's theory and the Survey's verification of it will result in placing the steam boiler on a fairly secure mathematical basis, the same as generators and motors are now on. Thus far the experiments check the theory excellently. The theory and results will be embodied in a special bulletin to be published soon, to be followed by later bulletins as the work proceeds.



A Lesson in Rope Splicing.



In the Machine Shop.

OSBORNE COLLEGE: AN ENGLISH NAVAL SCHOOL.

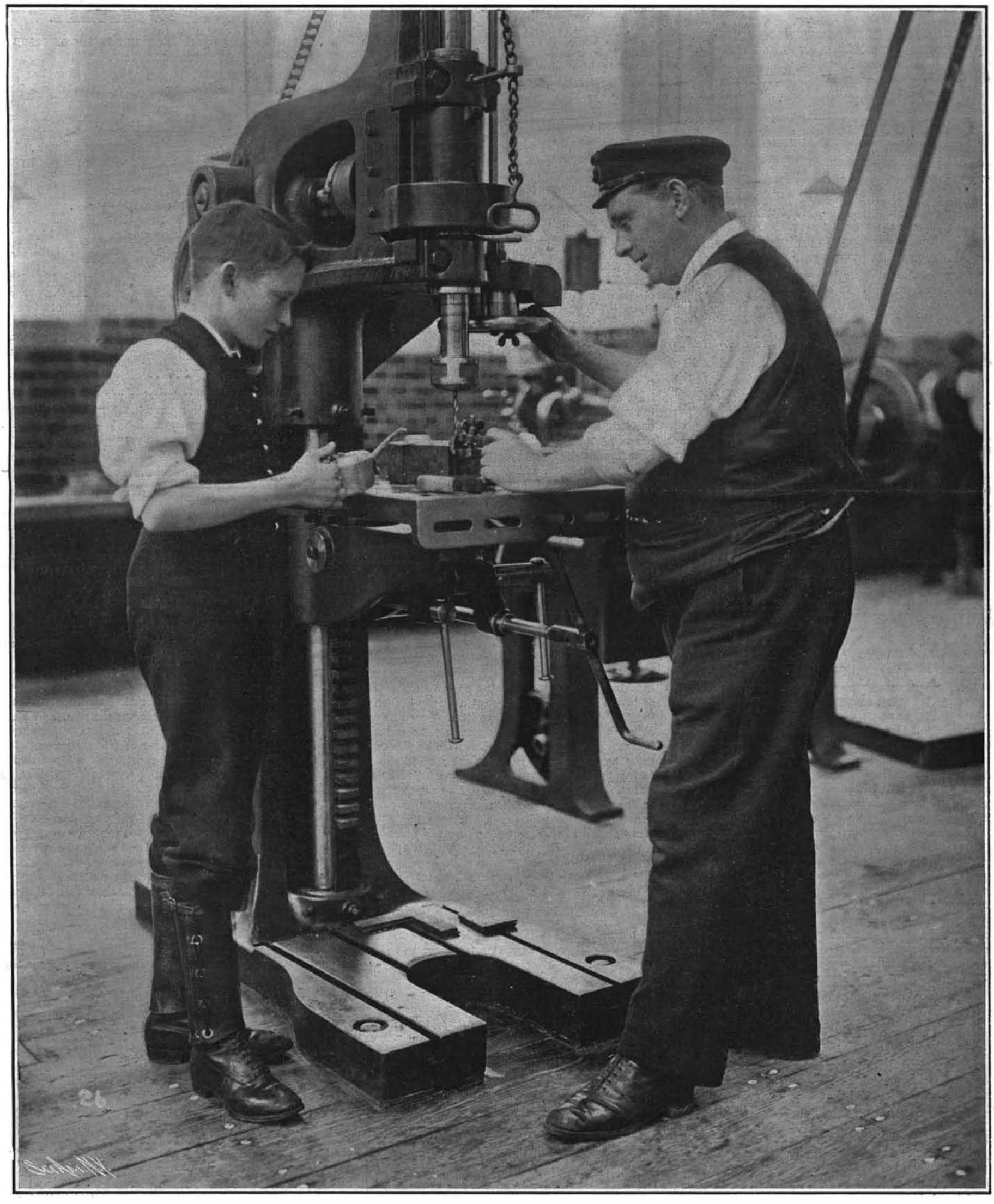
with the British service, however, is what is known as Osborne College, where boys are trained for various positions in the navy, special attention being given to technical branches. As the name indicates, the college is located on the Isle of Wight not far from the famous Osborne House, which was the summer residence of Queen Victoria for so many years. The institution is admirably situated for the purpose intended, being but a short distance from the sea, with grounds ample for the various drills as well as for the dormitories, instruction halls, and other necessary buildings. The students of Osborne College are obliged to enter between the ages of twelve and thirteen years, none being taken who are older than the age specified. They are instructed according to the new system adopted by the Admiralty Office in 1902, and are recruited largely from the sons of commissioned officers at present in the navy or retired. It may be said that as much care is taken in selecting students for Osborne as for the other service schools. The course of study here embraces not only the ordinary English branches pursued by boys of this age, but an elaborate system of physical culture, in which calisthenics and other evolutions enter. The first classes are taught the use of the pistol and other small arms, while the more advanced classes drill with various types of marine ordnance, from the rapid-fire gun mounted in the military top to the smaller pieces comprising the main battery.

The length of the course at Osborne College is four years, and in addition to the instruction referred to, the students are given lessons in the use of hand tools, both for wood and metal working, as well as power machinery of various sorts. Of course, a requisite

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1907, by Munn & Co.]

Vol. XCVII.—No. 3. ESTABLISHED 1845. NEW YORK, JULY 20, 1907. [10 CENTS A COPY $3.00 A YEAR.



Instruction in the Use of Machine Tools, Osborne College, England.

OSBORNE COLLEGE: AN ENGLISH NAVAL SCHOOL.—[See page 48.]