will be of great value in connection with their future vocation.

During the last year the members of the graduating class are put through a very rigid test, being required to spend at least four weeks in some forest region either in Pennsylvania or other States. They are sent to a lumber camp where they make a study of lumbering as associated with forestry. This month in the lumber woods is taken as a part of a course in lumbering in which each operation from the log in the tree to the finished product is thoroughly discussed. The men are provided with an outline to aid them in their studies and will prepare a complete report on the lumbering operation which they investigate. They are also placed during the summer vacations where they will get the most practical experience in forestry.

To get the men in touch with practical forestry as it is being carried on by private individuals through the State and in its various forest nurseries, as well as the work of manufacturing companies who put out tools and equipment used by the forester, one or more trips are made each year by the juniors and seniors, and it is planned to increase in so far as possible the usefulness of these trips. The students have visited various plantings of locust made by the Pennsylvania Railroad along its lines between Harrisburg and Philadelphia. In these plantations they studied the injury done by the locust borer and by mice and have learned that the locust was not a tree of value for general planting throughout the State. At Pottsville, the forestry work carried on over the Stephen Girard estate has been carefully studied. On this estate extensive planting has been done, but without the best results, because of injury from fire. Stone walls have been built and fire lanes or roads established which are as good an example of this method of preventing fire as can be found in the country. The advanced students have made trips through the southeastern portion of the State, visiting the large forest nursery of the Pennsylvania Railroad at Morrisville, which has been established by the Pennsylvania Railroad. This is reported to be the finest forest nursery in the United States. It had a million and a half of red oak seedlings grown from acorns which were set out in the spring of 1909. Industries associated with forestry, such as works showing the way in which wire rope and cable are used in logging operations, have been visited and where the students were able to see the making of all classes of saws from the crude material to the finished product.

This brief outline gives an idea of the broad and comprehensive scope of the instruction as carried out at this institution, but the opportunities for the graduates are such that the school authorities consider the work well worth while. There is such a constantly increasing demand for the trained foresters that it is much greater than the number who now graduate, while the salaries offered make it an inducement to a young man to take it up. The college continually has requests from large lumber companies throughout the country for graduates and sometimes under-graduates. The United States Forest Service is also another source of employment and this institution has already sent quite a large number into the national forests in Montana and other States. In fact the demand for graduates is assuming such proportions that expert forestry will undoubtedly become a vocation which will give many thousands employment, and the results at the Pennsylvania institution prove that similar schools established in other parts of the country will be of far-reaching benefit in solving the problem of conserving the national woodlands.

At the head of the State College is Dr. Hugh P. Baker, a graduate of the Yale Forest School, who was also connected for several years with the United States Forest Service. The State authorities have provided Dr. Baker with a staff of experts so that, as already noted, not only instruction but field work has been provided in literally every detail which concerns this subject.

In Pennsylvania forestry is taken up in connection with the work of the agricultural and mechanical departments of the State University, as it is believed this is the best method. As forestry is a production of a crop from the soil, in a sense it is agriculture, and because the utilization of the crop demands considerable knowledge of engineering, the instructors are able to give the students work in the departments of civil, mechanical, and mining engineering—just the kind of employment that they need. Consequently the work is closely connected with the vocation of the farmer, and the one who completes the course of study with the view of becoming an agriculturist is in a position to get the most and best of his woodland and to make it a permanent resource.

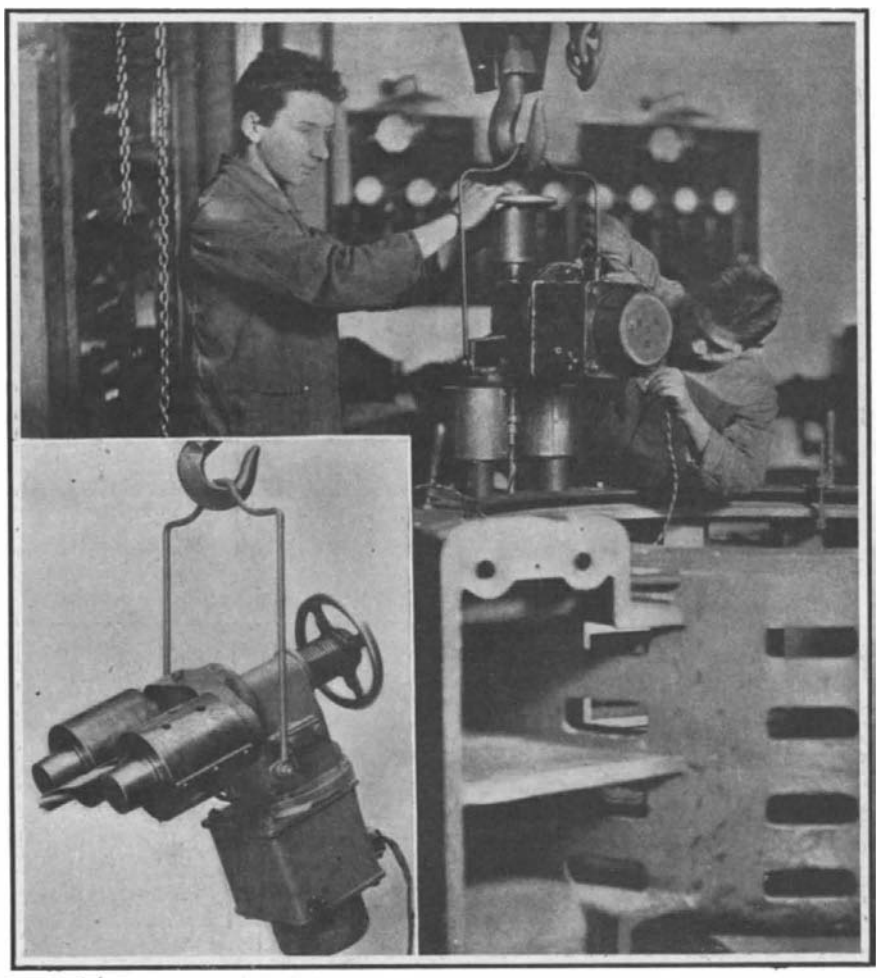
It may be added that the length of this course is four years, the first two years of which are devoted largely to foundation principles, which are absolutely necessary to the proper training of the forester. Beginning with the third year they take the men and give them two solid years of training along forestry and closely related lines. In connection with the actual forestry work the students take such subjects as fish and game preservation, diseases of trees, roads and trails, elementary irrigation engineering, elements of mining, in which they are taught in an elementary way the mining of various minerals, the timbering of mines and the laying out of mining claims. The students are also given a practical course in timber testing in their mechanical engineering department.

AN ELECTROMAGNETIC DRILL.

BY THE GERMAN CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A very efficient electromagnetic drill has recently been designed by the German engineer Burckhardt. This machine is intended for use in all branches of the iron industry, e. g., in boiler shops, ship yards, erecting shops, and the like.

The ingenious combination of an electrical motor with an electromagnet adapts this machine to all boring, milling, countersinking, and broaching. Electromagnets placed on both sides of the drill spindle throw the machine so tightly against the work as to allow any one of the operations mentioned to be carried out rapidly.



A NEW ELECTROMAGNETIC DRILL.

A special attachment on the drill spindle allows the tool to be rapidly and accurately centered on any given point of the working surface. The machine is thus adjusted within a few seconds.

As represented in the accompanying figures, the drilling machine is suitably suspended for this purpose. On horizontal surfaces the drill can obviously be used without any suspension. A special device is used in upward drilling.

The electromagnetic drill comprises four main parts, viz., the driving motor, the drill proper with its centering device, the electromagnets, and the suspension.

The motor armature drives the drill shaft through a normal toothed-wheel gearing. The shaft can be axially displaced with a view rapidly to adjust the drill point on the center mark. The balanced suspension device can be used for the same purpose.

The electromagnets are placed on a yoke, pivoted in the plate extension of the machine, and fixed with a nut. The magnet yoke, with its two coils, can accordingly be adjusted to any desired angle. A clamp screw is used to hold it in position.

The pole pieces fitted to the ends of the magnet coils are interchangeable. their length and shape being adapted to the tool in actual use, as well as to the form of the working surface. The pole pieces must be held as tightly as possible against the tool with their entire surface. The suspension device should be fixed at such height above the working floor as to allow the drill to be rapidly conveyed to any point of the shop. The tool is preferably a spiral drill of hard tool steel.

By employing pole pieces of different heights, drills of different lengths can be used.

The Psychology of Reading.

Examinations made by Erdmann and Dodge may serve as a foundation for the psychology of reading, and through careful experimental observation these scientists have reached results of extraordinary interest.

Hitherto two views have prevailed, the one being that reading was effected solely by spelling, each letter therefore being grasped and perceived for and by itself; the other being that the words were grasped not exclusively letter by letter but in small groups of letters in the same spaces of time.

We learn from their report in the Zeitschrift fuer Psychologie und Physiologie der Sinnesorgane that Erdmann and Dodge first ascertained through reflection of the left eye, while the head was kept in a steady position, that in reading an easily comprehensible text there is a regular change between pauses of rest for the eye and its movements. The number of these pauses, however, is much smaller than the number of the letters over which the eye glides, and it remains, in the case of the same person, almost unchanged as long as a fluent text is used. If the text becomes more difficult in the meantime, the number of pauses is increased a little, and where attention is given exclusively to the formation of words, as in "proofs," the number becomes three times as large.

So much having been ascertained, the next object was to ascertain whether reading was effected during the pauses of rest or whether the letters presented themselves with sufficient distinctness while the eye was moving to the right. Through perfectly exact observation and calculation both investigators came to the conclusion that reading was effected exclusively during the pauses of rest. On an average the eye glides, during a definite movement on the line, over a space of 1.52 to 2.08 centimeters, a space that contains about twelve to thirteen letters. The rapid change of the black and light textual elements—the letters and the interstices—makes it more impossible for the eye to recognize the letters while it is in motion. It was also ascertained that by a very brief exercise of vision, while the eye is still, four letters without exception, five at the most, can be recognized at the same time, even when they do not occur in a sequence of words. In the case of such a sequence, however, four or five times as many letters can be read during the same interval of vision. In the short pauses of rest while reading one recognizes the words solely from their optical collective form, if the letters are not too large, and such recognition is by so much easier as the words show themselves more characteristic and fluent to the reader. Even a beginner can therefore with a little practice enable himself to read not only without spelling but with a visual grasp of whole words at a time. How far this capability may reach depends on the optical memory of the reader.

Official Meteorological Summary, New York, N. Y., July, 1909.

Atmospheric pressure: Highest, 30.24; lowest, 29.46; mean, 29.93. Temperature: Highest, 92; date, 30th; lowest, 58; date, 4th; mean of warmest day, 84; date, 30th; coolest day, 66; date, 4th; mean of maximum for the month, 81.4; mean of minimum, 65.5; absolute mean, 73.4; normal, 74; deficiency compared with mean of 39 years, 0.6. Warmest mean temperature of July, 78 in 1901; coldest mean, 70 in 1884. Absolute maximum and minimum of July for 39 years, 99 and 50. Average daily excess since January 1st, 1.7. Precipitation: 1.98; greatest in 24 hours, 1.56; date, 23rd; average of July for 39 years, 4.32. Accumulated deficiency since January 1st, 2.15. Greatest precipitation, 9.63, in 1889; least, 1.18, in 1907. Wind: Prevailing direction, south; total movement, 7,922 miles; average hourly velocity, 10.6; maximum velocity, 46 miles per hour. Weather: Clear days, 13; partly cloudy, 13; cloudy, 5; on which 0.01 inch or more of precipitation occurred, 5. Thunderstorms: 16th, 18th, 30th. Coolest July in 12 years.