

THE OCCUPATIONS of machinist, boilermaker, blacksmith, etc., which require a high degree of mechanical skill and are necessary in time of peace, become a national asset in time of war. The importance of railway workers trained in these trades, during periods of national emergency, has been demonstrated during the past few months. A statement has been issued by the national government calling attention to the necessity of developing a body of highly trained industrial workers, so that the war may be pushed to a successful conclusion. It is, therefore, imperative that those in charge of training mechanics do not grow lax in their efforts and that the number of apprentices learning trades be kept to the highest possible point consistent with the shop efficiency.

Owing to the scarcity of skilled men at this time there is ample opportunity to place the more advanced apprentices on productive work. This will help the apprentice to develop confidence in himself, and in the meantime increase shop output. Present conditions again demonstrate the lack of a sufficient number of thoroughly trained mechanics.

It is unfortunate that it takes times like the present to wake us up to the fact that skilled men are an absolute necessity. Those concerns which have well-established apprenticeship systems have not fared as badly as those which are not so fortunate. However, it is also a fact with those concerns

that have a well-established system that apprentices have not always been hired with a definite degree of regularity. In order that apprenticeship be successful and supply the ever-increasing needs for skilled men it is imperative that

a definite minimum number of apprentices be hired every month, irrespective of industrial conditions for the time being. In many cases where too few apprentices were hired in the past the result was that at times like the present an insufficient number of graduates are forthcoming.

Much has already been written about apprenticeship but present conditions, due to the war, demand with increasing importance that the mechanical department of the railroad have a well-established apprenticeship system which provides:

First—The training of competent skilled and intelligent mechanics.

Second—The training of men for minor executive positions.

Third—The training of men, who are college graduates, for executive positions requiring an engineering education.

Fourth—School instruction co-incident with the work be-

ing done by the apprentices in the shop.

With the above objects in view, there are established on the Pennsylvania Railroad three grades of apprentices; namely, *Regular*, *First-class* and *Special*. The regular apprentices comprise the major part of the apprentices em-

THE PENNSYLVANIA Railroad has always given much attention to the training of its employees in the mechanical department. There has possibly been, however, too great an emphasis placed on the training of college men for the more important positions and too large a gap between the regular and the special apprentices. Mr. Yoder sketches the latest developments in the apprenticeship course from which it appears that this gap has been filled and that it is now possible for the regular apprentice to go as high as his abilities and energy will permit. Indeed, regular apprentices are encouraged to qualify for the more important positions.

The wisdom of modern apprenticeship methods advocated by such men as Basford, Cross and Thomas is being emphasized in the present emergency and it is to be hoped that the railroads will awaken to the absolute necessity of adopting such methods.

ployed. These graduate as mechanics and are given employment in the shops and engine houses. It is toward this class that the main effort is directed. The training is such as to embody every phase of shop work encountered in building or repairing railway equipment. At the end of the

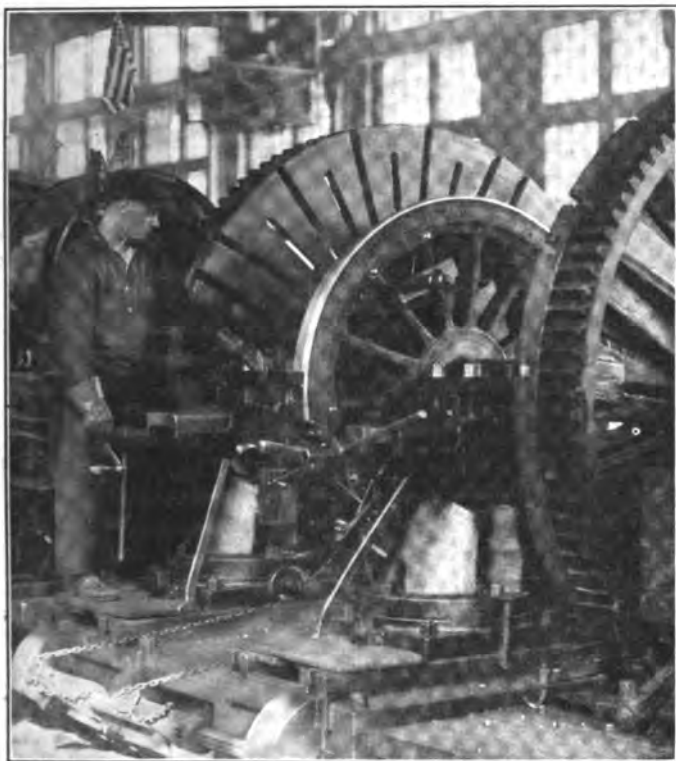
condition makes it imperative that the standard of the other grades be raised to fill this gap. It is encouraging to note too that the first-class apprentices are being used in many cases where special apprentices were formerly employed.

APPRENTICE SCHOOL

Perhaps no other factor has had a greater influence in improving the apprenticeship system than the establishment, by the company, of its apprentice schools. An experimental school was established in February, 1910, by having two instructors from the Pennsylvania State College conduct a class consisting of thirty selected apprentices. This class met twice a week for two hours each period and proved to be such a success that in the following September two instructors were employed by the company and placed on the rolls of the superintendent of motive power, Eastern Pennsylvania division.

The enrollment at the beginning of the first school year was 180 while in July of the following year this number had increased to 277. The development has since been rapid and within the last two years the instruction system has been extended to include all shops on the Lines East. There are now eleven schools, and apprentices at all shops receive practically the same training. The largest school is at Altoona, where 235 apprentices are now enrolled. In these schools apprentices are given a thorough training in the underlying physical and mathematical principles of their respective trades. The object is to give regular and first-class apprentices the benefit of education and thereby make them of more value to themselves and more efficient workmen.

The subjects taught unfold reasons for things done in the shops, the school and shop work being closely coordinated. Problems are given which require shop experience to be answered intelligently. In this way habits of observation are early acquired and the apprentice learns to analyze difficult situations and arrive at a proper solution of his problems. In addition a thorough grounding in practical mathematics and mechanics is included in the school course. The problems given are practical, and whenever possible are made



Third Year Apprentice Turning Tires in the Wheel Shop

four-year training they are highly skilled mechanics and can follow successfully any one of a number of activities.

First-class apprentices are appointed from regular apprentices after serving three years. They win this recognition through diligent application in both the shops and school and after having demonstrated their fitness to be advanced to the highest standing. Apprentices from all shops have opportunity to become first-class apprentices. If appointed to this advanced standing they must be transferred to Altoona, since all first-class apprentices are trained at these shops. The schedule embodies a wide range of all phases of railroad work which fits the first-class apprentice to occupy positions of minor responsibility and leadership upon the completion of his course. Many are appointed to important positions after proving themselves worthy and competent, and are in line for further advancement. *As a prize to the best and most capable, one first-class apprentice each year is advanced to the grade of motive power inspector and placed on the same standing as graduate special apprentices.* This means that if those so appointed continue to develop, they will be in line for promotion to the higher positions the same as graduate special apprentices.

Special apprentices are graduates of recognized technical colleges or universities who serve three years at the Altoona shops. The greater part of the time is devoted to intensive training in all phases of shop work, including car building and repairing, enginehouse work, and locomotive firing. The aim is not to develop skill and mechanical dexterity, but to give a general insight into shop conditions, locomotive operation, etc., so that as higher officials these men will be able to make judicious decisions on important work that may come before them as executives. It is unfortunate though that there are so few special apprentices at this time due to the unprecedented demand for college trained men. This



Third Year Apprentice Working in Link Gang

to apply to some phase of work which may come under the immediate observation of the apprentice. The texts used are especially adapted for instruction in Pennsylvania Railroad standards and methods. The instruction given covers

problems dealing with locomotives, cars, machine tools, screw jacks, blocks and tackle, thread cutting, gears, belts and pulleys, cutting speeds of tools, etc.

The apprentices who are more proficient and advanced in their studies are given courses in locomotive valves and valve gears, valve setting, materials of construction, strength of materials, locomotive boiler construction and operation, and in many cases applied elementary electricity. This work is arranged so that apprentices who have had a good schooling and those with initiative can advance to the higher sections early in their apprenticeship, and thereby obtain more of the advanced subjects and have greater opportunities to earn recognition as first-class apprentices. With this course of instruction apprentices become familiar with the underlying principles of their trade and receive the mental training to develop right methods of thinking. The apprentice school is making it possible for graduate first-class apprentices to be used to good advantage where formerly only special ap-

proper lines. Standardized shop schedules are furnished to shop officials for guidance in training apprentices in the various trades, so that all apprentices, no matter where they serve their time, will receive practically the same training. As an aid in a closer supervision of the work pertaining to apprentices, all shop schedules, together with rules and regulations, etc., have been issued by the general superintendent of motive power in the form of standard instructions No. A-1, "Organization and Rules Governing Employment and Training of Apprentices." These instructions tell definitely what each apprentice is to receive, while at the same time they set forth in a concise way what is expected of the individual apprentice.

With the new organization for training apprentices in both the school and the shop, boys entering the shops to learn a trade no longer find themselves part of a vast organization in which they have that feeling of being lost. They are being respected by the shop officials and the men employed and



Advanced Section Receiving Instructions in Mechanical Drawing, Shop Sketching, etc.

prentices were employed. It also enables graduate regular apprentices to qualify for important positions in time to come.

SHOP FOREMAN OF APPRENTICES

The successful operation of any apprentice system depends on the apprentice being given the right kind of instruction in the shop. In order to see that apprentices follow definite shop schedules and are given the right kind of work, the position of shop foreman of apprentices was established. This official is responsible for the proper observance of the shop schedules. He reports to the supervisor of apprentices, co-operates with the shop officials and sees that the proper instruction is given apprentices in the shop. He assists in placing the apprentice, after graduation, on work suitable to his ability. At Altoona shops he is assisted by the shop instructor. Many difficulties which the new boy assigned to a machine meets with are thus smoothed out and the output is kept at the highest point from the very beginning. The work of these men has increased materially the general interest and enthusiasm of the apprentice during the short time the plan has been in operation.

Since the establishment of the apprentice schools and closer supervision of the shop work, a decided increase in the interest toward apprenticeship has been shown by the shop officials and the men in the shop. Instead of apprentices being left to drift aimlessly about the shop and pick up a trade as best they can, their energies are now directed along

find all amiable and ready to assist them in every way possible. From the fact that apprentices are followed closely in their work, they early realize the advantages of putting forth their best efforts. With the added advantages of winning promotion from regular apprentices to first class, and from first-class apprentices to that of motive power inspector, there is increased incentive to strive for advanced standing. At the same time regular apprentices who have later developed exceptional ability along special lines have been placed in important positions, so that the new apprentice sees a definite future ahead and apprenticeship has become more attractive. As a whole an apprentice finds his four years spent in the shops a source of pleasure, and in years to come will look back to his apprenticeship with a great amount of pride. Apprenticeship has been the making of many a man, and, since the advent of the apprentice school and special shop supervision and instruction, it is believed that, next to a college education, it is the best preparation for a life vocation.

[Mr. Yoder's mention of the co-operation received from Pennsylvania State College is of special interest in conjunction with the article by Professor Arthur J. Wood of that institution, which will be found elsewhere in this issue. Active co-operation of this sort between our railroads and the colleges and universities is to be commended. A most remarkable demonstration of what can be done in this way is the work done by the co-operative engineering courses of the University of Cincinnati under the direction of Dean Schneider. —Editor.]