monotonous job which on a warm day is very conducive to drowsiness. On a rail gang the front flagmen can do good work putting the joints on rails, with two bolts in place, ready for "heeling in"; or he can score ties for adzing. The rear flagman can find plenty of work tightening bolts. On a surfacing gang the head flagman can make jack holes, etc., and the rear flagman can make himself useful dressing up track. This work keeps them wide awake and they are always on the alert for approaching trains.

The roadmaster and foreman should decide how each man should do his part of the work and should instruct him to do it that way. While instructing the men the progress will probably be a little slower; but in a short time the foreman will have the men working in unison and doing the work according to his system, which means the highest efficiency obtainable.

A green section foreman rarely makes a good extra gang foreman at first, but by giving him an assistant foremanship under a good extra gang foreman, and giving him personal instruction, the roadmaster can usually develop him into a good foreman. On this road outsiders are never hired for extra gang foremanships unless in emergency. Foremen are taken from the sections and developed; when their gangs are laid off they are again given charge of their regular sections, enabling the roadmaster to keep extra gang foremen at hand who understand the working conditions on the division.

On this road we work five classes: American whites, American negroes, Greeks, Italians and Mexicans. For all classes of work the Americans are the best, but a full gang is hard to obtain at current wages. For steel gangs I consider negroes far superior to any other laborers. They are active, strong and intelligent; and will work in unity. The "unison man" is ever present and is a strong factor in speeding the work and in keeping down the number of minor injuries to the men. In handling heavy material foreigners are not prone to move together, and this results in numerous personal injuries which could be prevented. The "unison man" should be present in every gang where there is danger of pinched fingers, mashed toes, etc. Of the foreign labor I consider Italians far superior for rail gangs. The Italians, Greeks and Mexicans stand about on a par for surfacing work. The Mexican is far superior when it comes to dressing track.

The Greek and Italian can always be depended upon in time of need, and the foreman can always figure on a full gang, as they hardly ever lose a day unless compelled to. But with the Mexican it is different. As long as he has a dollar he does not care whether he works or not, and the foreman is generally short handed for several days after pay day. One foreman who was an adept at card playing used to keep the Mexicans' finances in bad condition, and in this way he kept a full gang. The strong point in favor of the Mexican for extra gang labor is that they are not as clannish as the Greeks and Italians. Any time that a foreman wishes to weed out his gang he can do so without fear of losing the men that he wishes to keep. It has been my experience with Greeks and Italians that when the foreman discharges a drone he can also figure on losing every relative of this man.

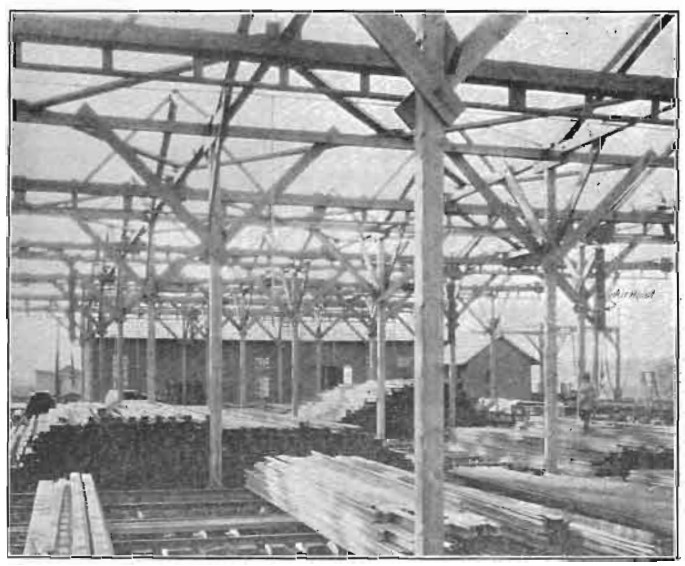
Good tools should always be at hand. Where the supply of tools is limited the foreman should carry a forge and anvil for repair work. Poor tools, such as chipped spike mauls, worn-out shovels, dull adzes and dull track chisels are time losers. The foreman should see that the men take proper care of the tools. In large gangs the men are apt to leave tools scattered along the track, and it is sometimes expedient to have a "tool man" to look after these, put handles in mauls, grind adzes, sharpen track chisels and repair other tools.

On one division where shovels were continually being lost and broken, and the extra gang foremen were ordering large numbers of shovels without being able to turn in the old ones, the roadmaster issued an order that each man should have his own shovel, and any time that he appeared on the work without it he would be sent to the bunk cars until he showed up with one. This soon did away with the scarcity of shovels.

CHICAGO, MILWAUKEE & ST. PAUL RAIL MILL.

The Chicago, Milwaukee & St. Paul operates a rail mill and storage yard at Savanna, Ill., to which all rail and fastenings removed from track are sent when released and from which second-hand rail and fastenings are shipped to various portions of the system as required. For several years previous to 1890 a portable rail saw was located at Watertown, Wis., but on this date a permanent plant was established at Savanna. As this mill was operated it was found that work could be done here more economically than at Watertown and in 1894 the latter plant was closed. Since that time all rails have been sent to Savanna not only from the St. Paul lines proper, but since the construction of the Chicago, Milwaukee & Puget Sound, from this line as well. A variety of work has been undertaken at this mill in addition to the straightening and sawing of rail until at the present time all tracks fastenings, including tie plates and angle bars are sent here to be reclaimed and surplus rail from the system is stored here until needed. This plant has developed to keep pace with the work until it is one of the largest mills in the country operated by a railway company for the recovery and storage of second-hand track material.

Most rail is commonly removed from track because of the



Chicago, Milwaukee & St. Paul Rail Yard, at Savanna, Ill.; Rail Mill in Background.

wearing away of the head on curves and the battering of the ends. By sawing off and redrilling these battered ends, much of this rail is suitable for further service in main lines, or at least in heavy freight or side tracks. All rails and fastenings are shipped to Savanna as soon as released from the track and are there sorted and worked over. If suitable only for scrap the material is placed on stock piles awaiting orders for shipment. If suitable for further use, it is passed through the rail mill, where it is sawed, straightened and redrilled and sent out to be used in the track again.

As this rail comes in it is unloaded directly on to skids leading to the saws. Before reaching these saws it is passed through a hydraulic gag press or straightening machine, where kinks and bends are removed. It then passes directly to the saws, of which there are two. These saws are circular and are spaced 31 ft. between faces so that one foot can be removed from each end of a standard 33-ft. rail at one operation. On rails of other lengths or where more than this amount is cut off, only one end can be sawed at a time. Before the rail is sawed the sawyers examine it and classify it as to quality, marking the rail accordingly. They also examine carefully the freshly sawed ends for flaws in the metal. After leaving the saws the burrs at the ends of the

rail resulting from the sawing are chipped off with chisels. The rail then passes to the drilling machines, four of which are provided, and two or three holes are drilled in each end for the fastenings at one operation of the machine. The rail passes directly from the drilling machines on to lines of rollers leading along stock piles. When the pile is reached corresponding to the number designated by the sawyer the rail is slid on to skids and then lifted on to the storage pile with an air hoist awaiting shipment out on the line again.

After passing through the mill the usable rail is divided into three classifications according to condition. The rail in the first class is suitable for important branch lines where smooth riding track is important. The second quality rail is used for less important branch lines and for heavy traffic freight tracks, while the third class is used for yard and side tracks. This year the first class has been further divided into two qualities, the second of which is used on important freight tracks.

The C. M. & St. P. has for a number of years sent large quantities of rails of heavy sections to Joliet, Ill., where they are rerolled by the McKenna process. These rails are sorted on their arrival at Savanna and those fit for rerolling are shipped to Joliet while the others are disposed of as outlined above. Short sections of second-hand rails of good quality are cut to the proper length for frogs and switches and are sent to the company frog and switch shops at Tomah, Wis., for use in making frogs and switches.

All lifting of usable rail in unloading from cars, handling on the stock piles and loading from the piles on to cars, is done by means of vertical air cylinders, to the lower ends of which rail tongs are connected. These cylinders move on overhead tracks which are carried on the timber framework shown in the accompanying view. With this arrangement one man can pick up three rails at one time, one inverted between two upright, as shown in the piles in the foreground, and transport them to any portion of the pile desired. In this way the cost of loading rails from stock piles on to the cars has been reduced to five cents per ton, while two men can unload 200 tons of rails from the cars on to stock piles in one day where no sorting is necessary.

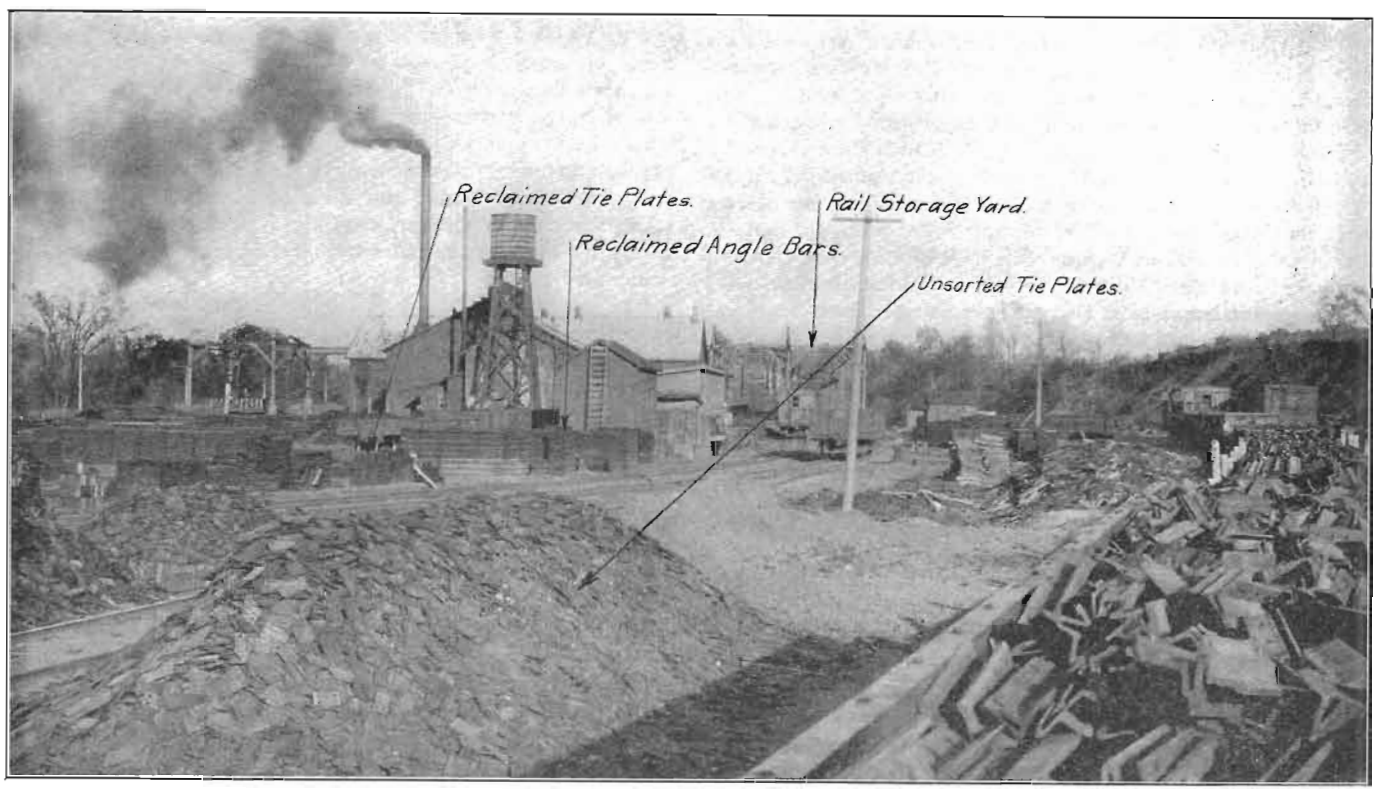
The average capacity of the mill is about 500 sawed, straightened and drilled rails per day of 10 hours, while the maximum number ever put through the mill in one day was 800 60-lb. rails. Two men unload the rails from the cars on to skids leading into the mills, three men work on the straightener, three on the saws, two chip the burrs from the rail and four are on the drill presses. From two to four men are employed on the stock piles, varying with the amount of material which is being handled. The cost of handling the rail, including the unloading, straightening, sawing, chipping, drilling and placing on the stock piles, averages about 50 cents per ton.

RECLAIMING TRACK FASTENINGS.

A very important part of the work done at this yard is the reclaiming of tie plates, angle bars, joints, etc. This material is sent in with the rail, frequently being loaded on the same cars.

A large proportion of the tie plates which are released are reclaimed here for further service. As the plates are received most of them have considerable wood and gravel adhering to the undersides between the flanges. To remove this the plates are piled and kerosene is poured over them and fired, burning out the larger portion of the wood. That which remains is removed by boys using hammers, chisels and small hooks made for that purpose. These boys also sort the plates into piles according to the kind of plate and also divide them between those suitable for main line, those suitable for side tracks, those requiring straightening, and scrap. The plates sorted out for main track are practically as good as new, while those for side tracks are inferior in that they are worn, corroded or slightly cracked. By using them in this way it is possible to tie-plate many side tracks at a very small expense with plates which would otherwise go in the scrap pile. The straightening is done with a 300-lb. air drop hammer falling about three ft. on to the plate. The plates are carefully stacked according to their kind and condition awaiting shipment, as shown in one of the accompanying views.

A large number of tie plates are repunched each year for sections of rail other than those for which they were originally intended. Last year about 200,000 plates, both malleable iron and steel, were handled in this manner at an approximate cost of $238.18, or $1.19 per thousand. With the increasing use of rail



Reclaimed Track Fastenings; Chicago, Milwaukee & St. Paul Yard, Savanna, Ill.

joints in place of angle bars a large number of joint tie plates are accumulating which are too long for use as intermediate plates. These plates are sheared to the proper length and repunched, the shearing costing about 50 cents per thousand plates.

Last year 107,487 new tie plates were shipped from this yard at a cost for handling of $75, and 495,000 second-hand steel and malleable iron tie plates were furnished from here at a cost of $1,371.56. Including the cost of punching the 200,000 tie plates referred to, the total cost of handling these 495,000 second-hand tie plates and putting them back into service was $1,609.74, or $3.25 per thousand plates, which included the cost of unloading, sorting, removing wood, straightening, piling in storage, and reloading. In addition to this, 224 tons, or about 20 per cent. of the total output of tie plates, were disposed of as scrap.

Many of the angle bars and joints received with the rail have to be worked over before being returned to the track. Large numbers of the 6-hole 40-in. angle bars which were commonly used several years ago are now being released. Many of these are badly worn at the top on the center directly under the end of the rail, especially if they come from double track. Because of this wear they cannot be returned to main track in their present condition. A 12-in. piece is therefore cut from one end changing the center of the bearing 6 in. and offering a new support for the head of the rail. The angle bar is repunched for larger bolts and for new spacing and is reslotted for spikes when it is again suitable for main line track. In reclaiming the angle bars three men are able to handle 1,000 bars daily. The cost of reclaiming these angle bars in this way is 0.8 cents per bar. A considerable number of Weber joints have recently been removed from the track after 10 years' service and these are also being repunched for larger bolts and returned to main lines.

A small excess and emergency stock of new rails is maintained here, although most new rail is shipped directly from the rolling mills to the point of laying. Sufficient track bolts and nutlocks are kept here to supply all rail shipped from this mill, but all track spikes are furnished direct by the store department.

Very careful records of the entire cost of operation is kept of the mill and of the material handled. A report is made four times a month to the inspector of rail at Chicago, showing the amount of new and second-hand rail on hand of the different weights and qualities, together with the amount of rail on hand to be sawed and straightened, and the amount of scrap. Similar information is shown regarding tie plates and angle bars. From this report the inspector determines the distribution of rail on the various requisitions and instructs the mill regarding loading.

Including those previously mentioned in the rail mill, about 45 men are employed, the larger part of whom are foreign. The labor expense of operation of the entire plant last year was $18,943, while the material expense, including fuel and storekeeper's charges, was $3,245. The amount of usable steel rail received was 20,676 tons, while 20,338 tons were shipped; 4,420 tons of new steel rails were received and 3,789 tons shipped; 12,428 tons of scrap steel rails were received and 12,560 tons of scrap rails disposed of; 1,761 tons of iron rails were received and 2,087 tons sold; 1,141 tons of new fastenings, including tie plates, were received and 1,876 tons forwarded, while 3,393 tons of old fastenings were received and 2,183 tons were shipped out. While considerably under the figures of some previous years, this tonnage represents about an average year's work.

This mill is operated under the supervision of J. G. Woodworth, inspector of rail, and John Reinehr, superintendent of the rail mill, to whom we are indebted for assistance in securing this information.

In an address given before the last annual convention of the American Wood Preservers' Association, Harold F. Weiss called attention to some experiments being conducted at the Forest Products Laboratory at Madison, Wis., and exhibited a piece of red oak which had been "conditioned" in a treating cylinder, with the result that its strength was more than doubled. In other words, by a manipulation in the cylinder this piece of oak was made twice as hard as it originally was. If it should be possible to develop this commercially there would be a great field for the treating of soft wood ties, such as loblolly pine, to secure a much harder and more durable tie.

THE TRACK FOREMEN OF THE FUTURE.*

BY WILLIAM J. POTTER,
University of Pennsylvania.

At the present rate of pay we cannot get a man of the required caliber to take the position of track foreman. We have two alternatives; either attract good foremen by compensating them for their ability and finding your return in the increased work of the less skilled laborers, or take the men you now have, and by the expenditure of much money train them to fill the positions with at least a fair degree of efficiency. The former of these two methods has proved to be applicable, with profits both by increased efficiency and by decreased costs. Is it not a mistake for railway managers to allow the question of immediate returns to blind them while the more important question, permanence of supply, is allowed to take care of itself? In the quest for immediate gain do they not in the long run suffer loss? The skilled men have been driven out of the business by the low wages paid. Our large and progressive roads are facing this problem, knowing that it must be solved, and the sooner the better. The Union Pacific has installed a series of lessons for trackmen, nine in number, reaching from the minor duties of caring for tools to the more technical training necessary to install a switch and grade curves.

I believe that by raising the wages of the foremen the standard of efficiency of the men, and the amount of work performed could be increased to make the investment a profitable one. Last summer I saw what a foreman can do if he has a proper incentive. This young foreman was the son of a farmer who lived adjacent to the roadbed. He had grown up on the section and loved the outdoor life too well to look for better opportunities elsewhere. Evidently he had been reading the new doctrines of efficiency and being of a practical turn of mind had begun to apply them to the work in hand. When lining track, he had all the men of one nationality working together, and he had previously picked out the fastest workers in each group. The roadbed had four tracks, so he divided his workers into groups of four, all within reach of his voice. After the track had been lined up properly and the men were about to start tamping, he would set the fast men on the right-hand track, and make the others keep pace with them. He established a certain amount of work to be completed each day, and when the men had completed their day's allotment they were allowed to go home. The men all accepted this idea and often worked hard during the noon hour in order to get the work finished on time. The men themselves prevented any individual soldiering. In direct contrast is the next section below, which is in charge of a foreigner, who is the despair of the road master. His tools are continually being stolen and broken by the men, his curves are so poorly watched that engineers from the main office are often out there checking; and he has no real control over the men under him.

The pay that is given section foremen, $60 for the road sections and $65 to $75 for the yards and terminals, is not enough to tempt men of ability to apply their best efforts in the interest of the company. Pay the best men high wages and see that they repay it by increasing the output of work. The work on the track is sufficiently standardized to permit the assignment of tasks,, making the men perform the task set, and paying them a certain proportion of the increased value of the work. Select foremen who are well qualified to set tasks for the men, give them high wages to see that the men perform the work as planned, and pay men proportionate increases for their extra effort. By investing in the high-priced men you can get a

*Received in the contest on The Section Foreman Problem, which closed March 25, 1912.