Above mag. made in N. Y.

Page 3

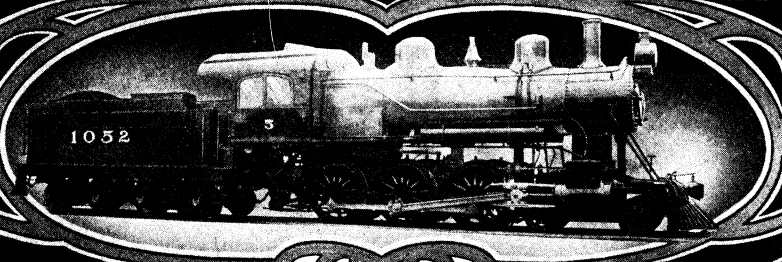
APRIL, 1909

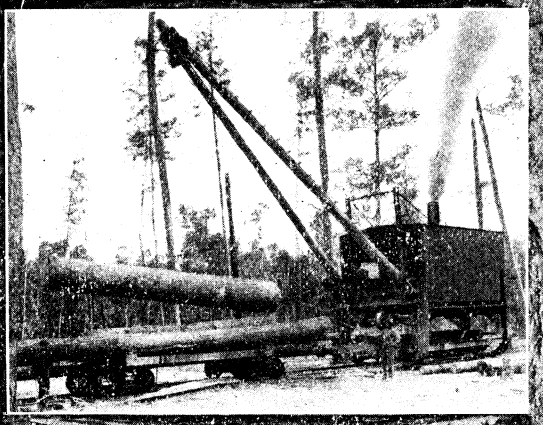
THE LOCOMOTIVE WORLD

LOGGING · MINING · INDUSTRIAL & STANDARD RAILROAD · PLANTATION · MOTIVE POWER

ENTERING HENRY-YARD LOUP CREEK BRANCH CHESAPEAKE & OHIO RAILWAY

PUBLISHED BY LOCOMOTIVE WORLD PUBLISHING CO. LIMA OHIO U.S.A.





The **McGiffert** is self-propelling.

It is a loader, skidder and switch engine combined.

It is powerful, requires no expert, loads any style car and is built for standard or narrow gauge track.

It handles all kinds of logs in all kinds of places.

It is the best all 'round loader built

McGIFFERT AND DECKER LOG LOADERS

ARE THE BEST "ON THE LOG"

CLYDE IRON WORKS
SOLE MANUFACTURERS

OFFICE AND WORKS
DULUTH, MINN.

BRANCH WAREHOUSE
NEW ORLEANS, LA. 421 CARONDOLET ST.

The **Decker** is also self-propelling and, in most respects, it is quite as efficient in loading as the McGiffert, only it is especially adapted where light steel or wooden rails are used.

It is equally powerful, of heavy construction and works to advantage under all conditions.

C-94

Mattocks

VOLUME 1 APRIL, 1909 NUMBER 12

THE LOCOMOTIVE WORLD

PUBLISHED MONTHLY BY

THE FRANKLIN TYPE AND PRINTING COMPANY

H. C. HAMMACK, EDITOR.

210 N. ELIZABETH ST., LIMA, OHIO.

Devoted to the interests of private users of Locomotives and Equipment for Logging, Mining, Plantations and Industrial Railroads.

SUBSCRIPTION RATES.

United States, Canada and Mexico.....50c a year
Foreign .....75c a year

NOTICE TO ADVERTISERS.

Advertising rates furnished upon application. Changes in advertisements intended for a particular issue should reach the office of The Locomotive World not later than the 20th of the month prior to the date of issue. New advertisements requiring no proof can be received up to the 1st of the month of date of issue.

IMPROVE YOUR TRACK CONDITIONS.

Any improvement in track conditions will lessen the cost of maintenance. This is a settled fact. However, the majority of improvements are very expensive and as a rule unless you are operating a common carrier road the traffic does not justify going to the additional expense.

With the private users of locomotives as well as the standard railroads, the locomotives and cars which are now required are being built of greater power and capacity, consequently it is necessary to construct them of such height that their center of gravity is raised considerably over what was customary a few years ago, and the mass of parts overhanging the wheels of locomotives especially has been increased to such an extent that the excess weight thrown to one side or the other of the track by reason of elevation on curves, track out of alignment, etc., is out of porportion to the ratio of increase in dead weight of the load as a whole.

Engineers for the standard railroads have brought up the question as to what is the best remedy to overcome this instability or top-heaviness occasioned by the increased height and weight of locomotives and cars, and it has been deemed advisable to increase the length of ties over the universal standard of 8 feet. It is reported that some of the roads have recently made 8½ feet the standard, while many of the engineers of track maintenance believe that a length of 9 feet would more nearly meet the requirements, as the longer the tie the greater the bearing surface and the less pressure on the ballast, which increases the stability of the track. This is a point which should receive careful consideration by owners of private railroad lines, as well as standard railroads, as while the locomotives and cars used are not so large and of so great capacity as are used by standard railroads, yet heavier equipment is being ordered

each successive year and no doubt this same trouble is found to exist. It seems as if the longer tie would be a requirement more needful on the private railroad lines than where the track conditions are more perfect, as it is a well known fact that the alignment of track on the average private line is much worse than on the standard railroads. It is not an expensive improvement, consequently the cost would not make it prohibitive, and it certainly would render much more efficient service at the same time reduce the cost of maintenance to motive power and rolling stock.

POINTS WORTHY OF CONSIDERATION BY THE LOCOMOTIVE BUYER

Private users of locomotives may not have conditions justifying high speed passenger or heavy monster freight engines such as are used on the trunk line raliroads, yet there is no reason why they should not insist on the latest improved and most carefully designed locomotives which can be had in order that they obtain the best possible results. It is therefore well for the purchasing agent or party having in charge the buying of locomotives for private individuals or corporations to investigate the design offered thoroughly before purchasing. Locomotive practice has changed greatly in the last fifteen years and the locomotive with small boiler with large cylinders is a thing of the past. It was thought years ago that all that was necessary was a locomotive with large cylinders, but scientific investigations have proven that the boiler is the main factor in the locomotive. In other words, the locomotive capacity is limited to a great extent by the capacity of the boiler.

A well designed locomotive will have its cylinder power proportioned to its weight and the ratio of heating surface in due proportion to its cylinder volume. These correct proportions are not well known or understood by the private user, but it has been found in tests made by our most learned engineers that the proper proportion of weight on drivers to the tractive power (cylinder power) varies from 4 to 4.5 to 1 on tender engines to 4.5 to 5 to 1 on tank engines. This ratio is known among locomotive builders as the "ratio of adhesion" or "factor of adhesion". An engine with a less proportion than what is mentioned will be found to be slippery or in other words the engine will be over-cylindered. The proper ratio of heating surface to cylinder volume on road engines is 225 to 250 to 1 and 190 to 225 on switching engines. Another feature is the ratio of grate area to cylinder volume. The ratio which is regarded as good proportion is 1 to 3.5 to 4 or in other words for every cubic foot of cylinder volume there should be from 3.5 to 4 square feet of grate surface.

Of course there are other points in connection with purchasing locomotives which should receive careful consideration by the buyer. However, these points last referred to are only minor compared with those mentioned, as the observance of same means greater efficiency, economy and more work.

AFRICA WILL SOON HAVE LONGEST RAILROAD IN WORLD.

With the completion of the Cape Town-Cairo Railway in Africa will give to the world the longest railroad. This road will connect North and South Africa and will be in the neighborhood of 6,400 miles long. The cost of this road when completed will reach close to $1,000,000,000,000. Although this is an immense sum it is comparatively small when it is considered what it will be to Africa, in fact the entire world. It will make possible for the traveler to journey from Berlin or Paris to Cape Town in ten or eleven days. The country which it will open up is rich in almost everything in the mineral world such as gold, silver, copper and diamonds. Only 2500 miles is yet to be completed, which is between Khartum, in the British Egyptian Soudan, and Broken Hill, a point in Rhodesia.

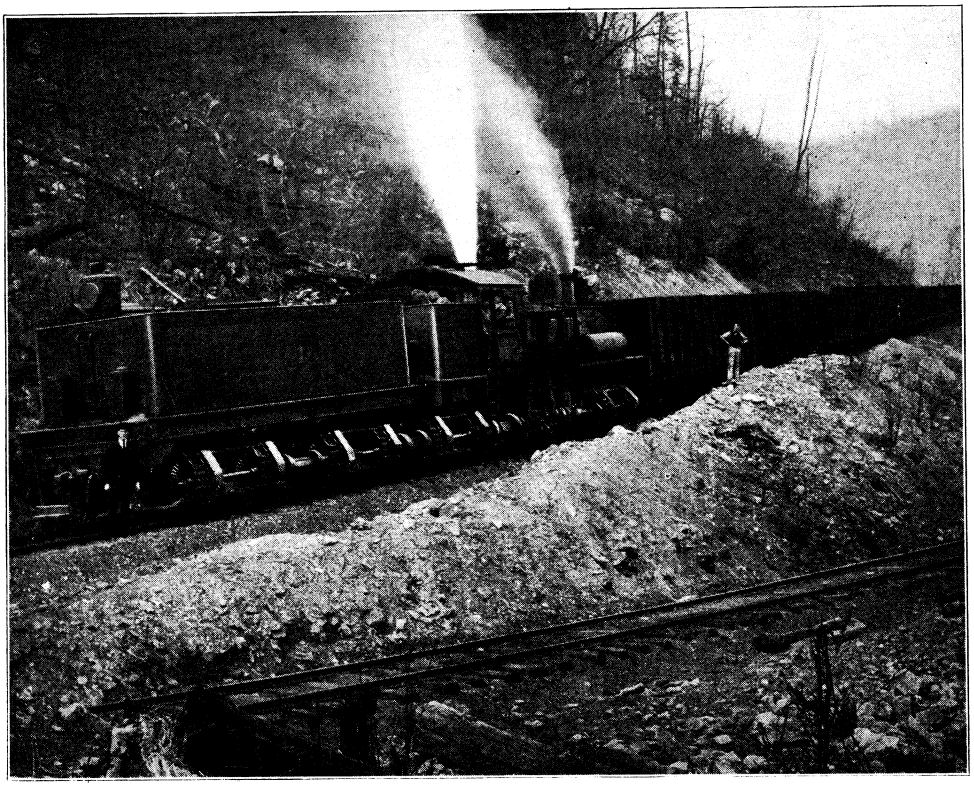
RUSSIAN LOCOMOTIVE BUILDING.

The number of locomotives built in Russia last year was 634, as compared with 759 in 1907, 1,010 in 1906, 1,409 in 1905 and 1,102 in 1904. Of the locomotives built last year, 235 were passenger engines and 399 goods engines. The corresponding proportions in 1907 were: passenger engines 297, goods engines 462; in 1906, passenger engines 19, goods engines 991; in 1905, passenger engines 26, goods engines 1,383; and in 1904, passenger engines 213, goods engines 889. Of the engines built last year, 476 were supplied for the Russian State lines, and 158 for private companies. The corresponding proportions in 1907 were, for the State 667, for private companies 92. The orders obtained thus far this year comprise only 250 passenger engines and 100 goods engines.

One of America's Greatest Coal Roads

The Chesapeake & Ohio Railroad, the road referred to in the title of this article, is one of the greatest coal roads now in operation and it traverses the new River and Kanawha districts of West Virginia, the heart of the Appalachian coal fields, the richest coal fields in the world. The Appalachian coal field of the United States extends from the northern border of Pennsylvania to Central Alabama, a distance of 850 miles. It embraces portions of nine states and contains approximately 70,800 square miles, of which 75 per cent contains workable coal. This coal field is noted not alone for its size, but by reason of the quality of the coal, and the output includes the best coking coals, steam coals and gas coals to be found in the United States, if not in the world.

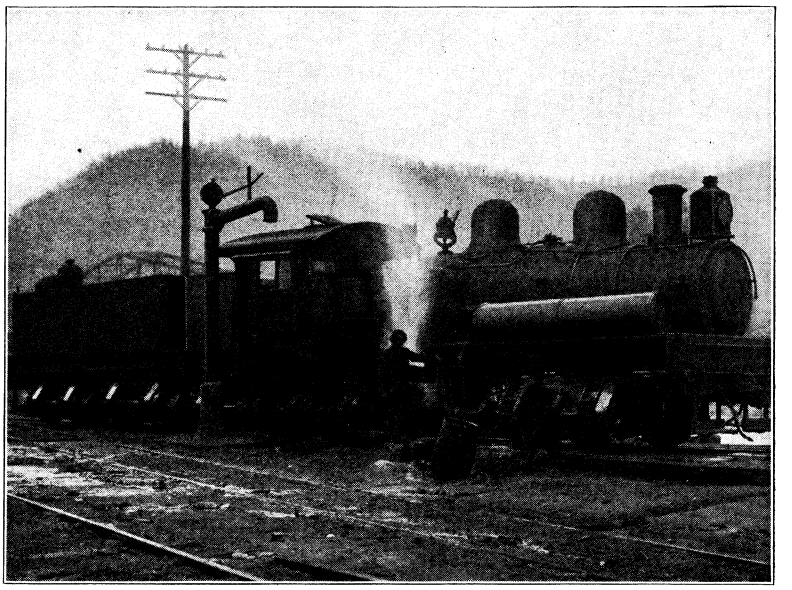
The coal fields of West Virginia are found in the widest part of the Appalachian field and according to the latest map of the United States Geological Survey, West Virginia contains 17,000



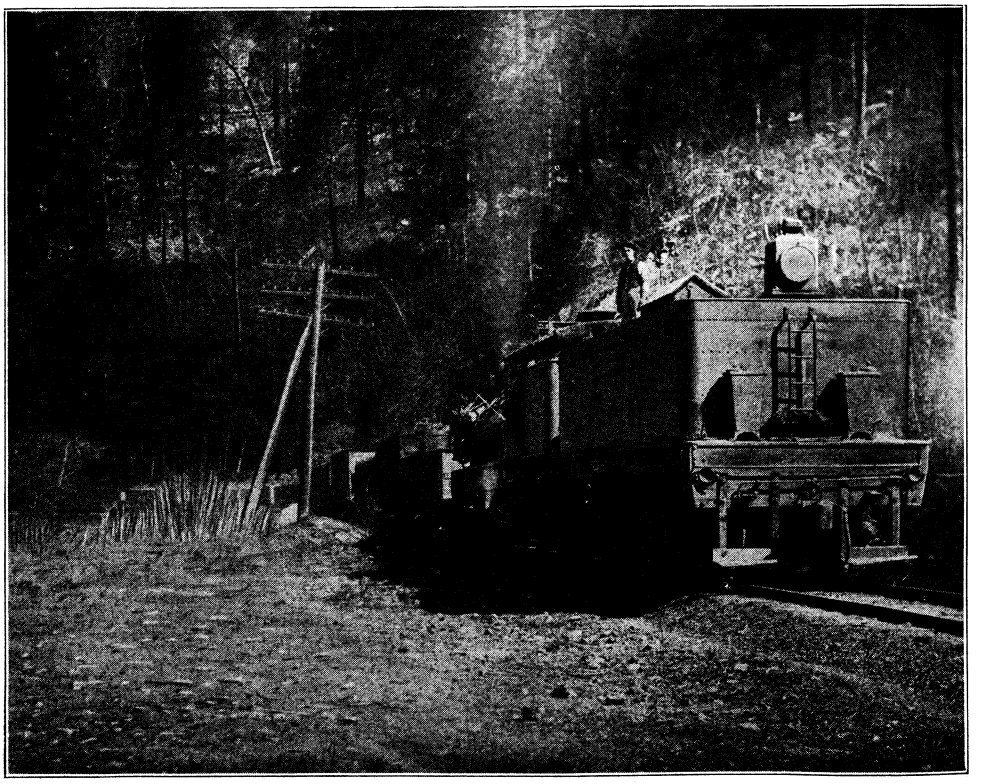
SWITCH BACK. 4½% GRADE, LOOP CREEK BRANCH, C. AND O. RY.

square miles of workable coals. The original coal supply, including coal that is easily accessible and also what can be won with difficulty, is estimated to be 231,039,000,000 short tons. To show that the state of West Virginia is a prominent member of the family of coal producing states, we would mention that in 1870 it produced only 608,878 tons of coal or 1.8 per cent of the total production of the United States and in 1907 it produced 48,091,583 tons, or 10 per cent of the total production. The total production in this state up to January, 1908, was 650,000,000 tons, or say three tenths of 1 per cent of the coal originally in the ground. As the eastern margin of this great coal field forms the western border of the sharply folded Appalachian Mountain belt it can at once be seen that to reach the mines by rail will necessitate surmounting very difficult country where heavy grades and sharp curves are prevalent.

The Chesapeake & Ohio have laid many branches from their main line into the heart of the coal field, the most important ones being Loup Creek Branch; Cabin Creek Branch; Keeney Creek Branch; Rends Branch and Laurel Creek Branch. The engineers, in laying out these branch lines, although they employed the use of many switchbacks, still found it necessary to have maximum grades of 4.5 per cent and numerous sharp curves. When we consider the facts before stated relative to the production of coal in the state of West Virginia, and also that the Chesapeake & Ohio branches reach the heart of this great coal producing district it is enough to say that the methods employed in operating these are and should be the most up-to-date and economical in order to satisfactorily handle the traffic. The figures given also show that there has been a great increase in the production of coal from year to year which indicates that the traffic on these branch lines has been increased year after year. This in itself would call for closer attention from the operating department, even though no difficult road conditions had to be overcome.



GEAR LUBRICATING APPARATUS, THURMOND YARD



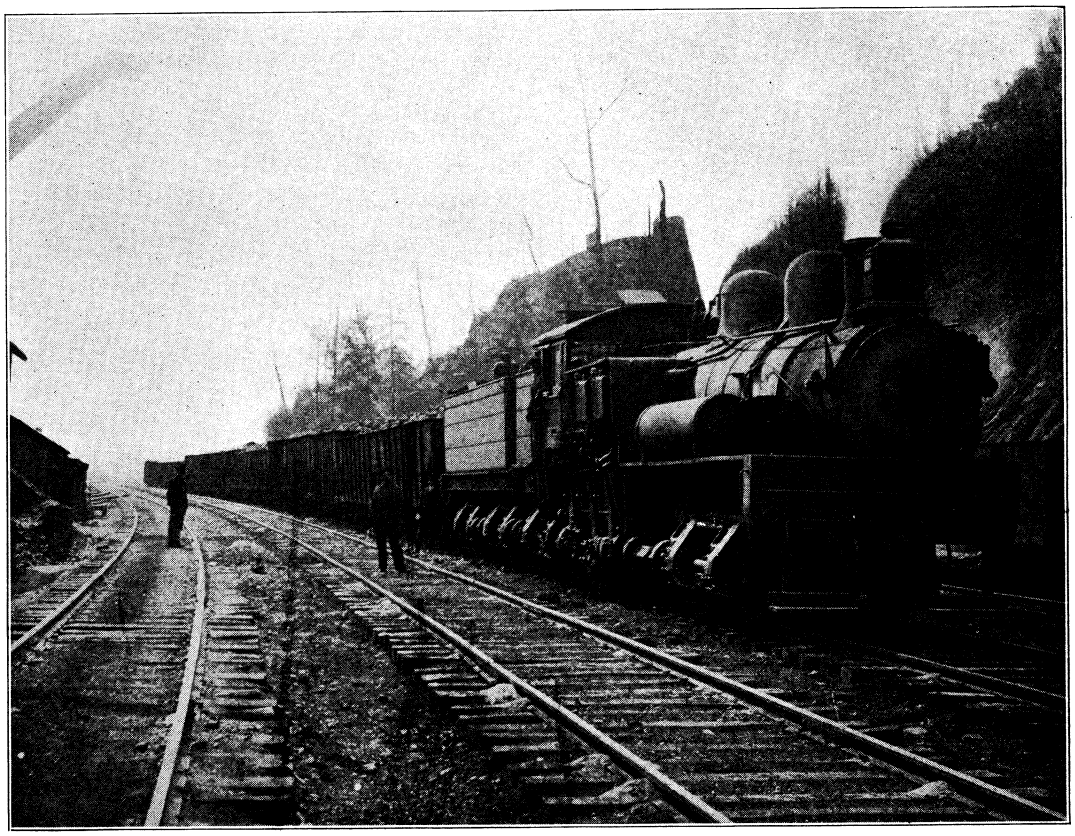
TRAIN OF THIRTY EMPTIES ON 20° CURVE, 21½% GRADE, REND BRANCH, C. AND O. RY.

When these branch lines were opened the locomotives used to operate the road were 20x24 cylinder Consolidation

ERRATA

Through error, description under cut at lower left-hand corner of Page 4 reads: "21½% grade;" it should read: "2½% grade."

engines of the standard type, but it was soon found that something had to be done in order to avoid continuous delays of trains stalling on the heavy grades. The Motive Power Department set about to find locomotives capable of handling the traffic under the difficult conditions, and the search culminated when five years ago the C. & O. purchased a hundred and fifty ton Shay Geared Locomotive, built by The Lima Locomotive & Machine Co., of Lima, Ohio. This locomotive was placed in service on the Keeney Creek Branch and it is learned from Mr. J. F. Walsh, Superintendent of Motive Power that after a trial of two years and nine months an order for five more locomotives of the same size was placed; another one for service on this branch and four for service on other branches, and subsequently three more were ordered. Nine of these monster locomotives are now owned and operated by the C. & O. Railway; four of these are in service on the Cabin Creek Branch, two on Keeney Creek Branch, and one on each on the Rends, Loup Creek and Laurel Creek Branches.



TRAIN OF FORTY-FIVE STEEL LOADED GONDOLA CARS LEAVING HARVEY YARD, LOUP CREEK BRANCH

These locomotives have great hauling power, much more than the standard type by reason of the weight all being on drivers, and no dead load required to be hauled as part of the train. The writer witnessed one of these engines working on the Loup Creek Branch which was making six trips per day, hauling 45 steel hopper cars of fifty tons capacity at each trip, or a total of 2250 tons per trip, making 13500 tons daily. Five engines in this district are handling sixty-seven thousand five hundred tons daily. One of the most important features of these monsters is the complete safety in which they handle the loads down the 4.5 per cent grade on the above branch from McDonald to Thurmond, W. Va. which is five miles long. This is made possible by the excellent braking and holding power characteristic of this type of locomotive. Disastrous run-aways were frequent on this difficult run previous to the installment of the Shay, but it is stated by the officials of the road that this trouble has been entirely eliminated.

(Concluded on page 6)

ONE OF AMERICA'S GREATEST COAL ROADS

(Concluded from page 5)

The main line of the Chesapeake & Ohio is 512.8 miles long, and runs from Old Point Comfort, Virginia through the winding ranges of Allegheny and Appalachian Mountains to Cincinnati, Ohio. The length of its branches is 662.1 miles, which makes the total length of the lines owned by this Company aggregate 1174.9 miles. Besides it controls lines under lease and has trackage rights for 656.8 miles, making the length of the entire system 1831.7 miles. The main line is laid with one hundred pound steel on stone ballast from one end to the other, and the trains operated are the most modern and best equipped of any railroad in America. Notwithstanding this fact, three fifths of the revenue of the entire system is obtained from the tonnage hauled in the coal district.

We are able to present herein some views on the Rends and Loup Creek Branches which enable the readers to form an idea of the conditions which are necessary to overcome.

REMARKABLE RAILWAY ACCIDENT.

One of the most remarkable railway accidents which has happened for some time occured at Montreal, P. Q., Wednesday morning, March 17, 1909. The results are a wrecked Terminal Station, and six persons killed. All due to a broken spring hanger which allowed the engine to lean to one side so that the driving wheel struck the mud or washout plug, breaking it off. The details of the accident are as follows: The Canadian Pacific Ry. night express train from Boston to Montreal, came into the Windsor Terminal at Montreal out of control, both engineer and fireman having been disabled by escaping steam, and though the emergency brake cord had been pulled by the brakeman when nearing the station the train still had enough momentum to break through the bumping-post and run through the walls of the terminal station. Four persons were killed in the waiting room, and the engineer and another were so badly injured that they died the next day. At the coroner's inquest the following facts developed: The engine had been in excellent condition, and only three days before had undergone some minor shop repairs. Two slight leaks in the boiler had been repaired in the preceding few months, one of them by a patch, but this was found to be perfectly sound after the accident. The wrecked train consisted of the engine and four cars. When approaching Highlands, near Montreal, there was something wrong with the engine. At Highlands the engineer on examination found the engine brake rigging broken and removed part of it, and also found a spring hanger on the left rear driver broken, which he also removed. There was a leak of steam, but not serious enough to prevent the engineer from proceeding the few miles to Montreal, the end of the run. When within some two miles of the terminal, there was a sudden escape of steam and hot water from beneath the left side of the cab, the fireman jumped, and half a mile farther the engineer either fell or jumped (he was badly scalded and later died of his scalds.) The train ran on with open throttle. The other trainmen became alarmed at the high speed of the train through the yard approach, and at the point 1,600 to 2,000 ft. from the station (measured from the bumping block) a brakeman pulled the emergency cord. The brakes went on promptly, but as the engine brake was disconnected there was only the braking power of the four cars to reduce the speed, and the train ran through the bumper and through the brick wall of the station into the waiting room. On examination it was found that a washout plug on the left side of the firebox had been broken off, and there were marks of the driving wheel on the side of the firebox. Mr. H. H. Vaughan, Assistant to the Vice-President, explained the accident as the result of lurching or leaning of the engine due to the broken spring hanger, which allowed the driving-wheel to strike the plug and break it off. The escaping steam and water would not have directly struck the engineer, he being on the other side of the cab, but he probably bent down to see what the trouble was and thus was scalded so badly that he could not shut off steam and apply breaks before falling or jumping. The reduced braking power of the train, Mr. Vaughan testified, would have left the train a speed of some 25 mi. per hour at the bumping post. The coroner's jury held that there was no negligence shown.

TUBE PLATE TROUBLES.

The most troublesome detail of the large modern locomotive boiler is probably the firebox tube-plate, and it is only at the expense of the best of material and the most careful workmanship that this can be relied upon for even a moderate period, to withstand satisfactorily the severe strains entailed in service.

The tube-plate frequently appears to become bulged and distorted soon after being put to work, and we are inclined to think a common fault is too much rigidity in the staying of the structure which prevents the internal firebox, as a whole, from adjusting itself readily to the varied demands of expansion and contraction. After the plate has once become bent, cracks between the tube holes or across the "bridges" rapidly develop, and a new tube plate soon becomes a necessity.

A skilful arrangement of the roof supports and distribution of the stays at the sides doubtless obviates much stress from over-rigidity, hence the innumerable attempts at flexible stays, etc.

Considerable assistance may be rendered in the direction of allowance for undue strains of expansion and contraction by following certain approved methods in the manufacture of boilers and fireboxes. If the inner and outer fireboxes could be kept warm—that is to say, at a uniform temperature of say 150° F.—whilst they are being stayed together and having the tubes introduced and secured, the effects of future expansion and contraction would doubtless be considerably modified. Failing the ability to adopt such a procedure, we must look to other details in the work of construction to minimise strains set up in working.

If the two rows of stays round the sides of the firebox, nearest the tube-plate, are left out until the tubes have been inserted and expanded, it is claimed that satisfactory results will follow, and cracking of the tube-plate between tube holes will be obviated. This procedure doubtless permits of better equalization of stresses in both tube-plate and side sheets.

Another precaution against "bulging" suggested by practical men is to leave out the second vertical row of tubes on each side of the tube-plate. This tends to stiffen the plate in the neighborhood of the sides.

The expanding and rolling of the tube ends should be effected gradually and carefully all over the area of the tube-plate. No one row should be finished off at the first application of the expander, but each row and all the tubes systematically dealt with in turn.

The "bulging" of the tube-plate in large boilers is certainly due to the "thrust" of the long tubes, and this will naturally be more emphatic when brass or copper is the material of which these are made than when steel is employed. The use of the latter enables thinner metal to be used, and this presumably assists in reducing strains due to thrust.

The introduction of flexible tube-plates has often been advocated, and we believe attempts have been made to provide for expansion and contraction of the tubes by "dishing" or corrugating the outer ring of the plate, but results have not been altogether satisfactory.—*The Locomotive Magazine.*

NEW RAILWAY SWITCH.

A new railway switch has been tried experimentally in England, the special feature of which is that the switch rails have a movement in a vertical arc instead of merely sliding in a horizontal plane. The movement is similar to that of the detector bars used in interlocking plants, except that it is transverse to instead of parallel with the track rails. The device resembles an ordinary split switch, but the head rod connecting the two switch rails is attached to short vertical links or arms on horizontal studs parallel with the rails. When the switch mechanism is operated (in the usual way) the horizontal pressure against the rails causes them to move laterally, and the links compel them to travel in a vertical arc in their movement from one position to the other. An advantage claimed for this arrangement is that there is little liability of any obstruction lodging between the switch and stock rails, while it also ensures the switch rail being properly home against the stock rail in either position of the switch. This switch was described in the July 17 number of "The Engineer," of London, England.—*Engineering News.*

UTAH & SOUTHERN ROAD TO BE BUILT.

Information that will be of interest in railroad circles and that has just been given out officially, is that of the proposed construction of the Utah and Southern Railway, which will open up the iron and coal deposits in Iron and Washington counties, Utah.

The headquarters of the company are located in Los Angeles, with Charles T. Inman, Los Angeles, president, George Foreman, Los Angeles, vice-president; J. F. Angell, general manager, Columbus, O.; H. L. Weber chief engineer, Bucyrus, O.; and C. L. W. Rood, Los Angeles, resident engineer.

Mr. Weber, who is an engineer of wide experience in railroad building in the east, has, with corps of engineers, just completed the location of the road from Lund to Iron Springs, Cedar City, Kanarra and New Harmony, some fifty-six miles in length. The road will be financed by eastern and western capital, and the promoters promise that active work will be begun on the new line soon, the citizens of Iron and Washington counties having rendered every assistance possible to the engineers in locating the line.

Mr. Weber recognizing the great value of the undeveloped resources of southern Utah, determined to form an organization to develop them, and his more recent investigation has increased his enthusiasm over the prospects. The chief engineer, after having completed his portion of the work of location, left for the east for the purpose of financing the project, Resident Engineer C. L. W. Rood of Los Angeles remaining in charge to complete the engineering details.

RAILROADS ACTIVE IN THE NORTHWEST.

More miles of railway lines are under construction in the inland empire, taking in 150,000 square miles of territory in eastern Washington northern Idaho, western Montana, northeastern Oregon and southeastern British Columbia, than in any other similar area on this continent. The mileage in Washington alone is 1500 and the works in the other three states and province will bring the total to 3000. Approximately 650 miles of line were built in Montana last year, when that state headed the list in the Union for new work. There are at present 4595 miles of main lines, branches, yard tracks and sidings in Washington, which was second with between 500 and 600 miles built in 1908. The completion of the main line of the Chicago, Milwaukee & Puget Sound railway will add as much more. In addition to this, approximately 1100 miles of steam and electric lines are projected to be completed before 1911.

Steam roads now in operation in the inland empire are the Great Northern, Northern Pacific, Chicago, Burlington & Quincy, Spokane Falls & Northern (Hill property), Spokane International (Canadian Pacific system), Oregon Railroad & Navigation company (Harriman system), Central Washington, Idaho & Washington Northern. Robert E. Strahorn, president of the North Coast Railway company, building from Spokane to the sound, announces it will be part of a transcontinental system, the name of which he will not give out at present. The Canadian Pacific also will be extended from Spokane to the Pacific coast. These lines make Spokane the greatest railroad center west of the Missouri river.

ANOTHER NEW LINE.

In addition to these activities, it is unofficially announced that the Canadian Pacific and the Milwaukee systems will be connected by a new line to be built from the Canadian boundary south down the Flathead valley to Kalispell, Mont., and from a point on the Milwaukee north to that city. With this stretch of road, sixty miles north of Kalispell and seventy miles south, the Milwaukee will be able to reach the coal fields in British Columbia, and the Canadian Pacific road will find an outlet traversed by the Milwaukee's coast line for lumber and coal products on its lines north of the International boundary.

There are reasons to believe that the Canadian Pacific will be a factor in the inland empire. The Company already has entrance to Spokane over the Spokane International line, built by D. C. Corbin of Spokane, and it is now stated that a further extension will be obtained to Portland over the Oregan Railroad & Navigation Company's lines. While this will cut into the Hill, Harriman and Earling territory, there is enough business in sight for all.

Economy of operation and facility in handling freight from the east to southwestern Washington and western Oregon by way of Spokane have been greatly promoted by the opening of the Spokane, Portland & Seattle line along the Co-

lumbia river, giving an outlet over practically water grades for traffic which formerly went over the Northern Pacific and the Great Northern lines.

WILL AWARD CONTRACTS.

C. B. Pride, hydraulic engineer of the Chicago, Milwaukee & Puget Sound railway, says that contracts will be awarded shortly for two electric power plants in the Bitter Root mountains to furnish power for the operation of more than 100 miles of line on the Idaho division, between St. Joe, Ida., and St. Regis, Mont. The plants which will, as at first constructed, furnish 30,000 horsepower are to be on the St. Joe river at St. Joe, Ida., and on the Missoula river, forty miles below Missoula, Mont. The grades and curves are heavy, the former ranging from 2½ per cent. to 4 per cent. Several other possible power sites have been located, and if it is deemed advisable later to install electrical operation over a greater portion of the road, additional plants can be established.

More than 150,000-horsepower electrical energy is developed in and near Spokane, and there is at least 500,000-horsepower available and undeveloped. The expenditure upon electrical plants and service amounted to $3,000,000 in 1908. The Washington Water Power Company, of which Henry M. Richards is president, announces that $16,000,000 will be expended at the rate of $2,000,000 a year in extending its city and interurban electric railways and light and power plants, and the Spokane & Inland Electric Railway system, headed by Jay P. Graves, also has plans for extensive works, in addition to the projects now under way. This company is surveying a line into the Big Bend wheat belt.

THE DEEPEST METAL MINES OF THE WORLD.

As our readers are aware, the deepest gold mine is the Victoria Quartz at Bendigo, in Australia; this mine has a vertical shaft that has been sunk to 4300 ft. and a winze that is 225 ft. deeper, making the total depth 4525 feet. In these deepest workings a saddle-reef has been cut, but it does not carry pay ore, in fact, the Victoria Quartz Company has asked the Government of Victoria for a grant of £10,000, and the Minister of Mines has replied that he would provide the money if the company would agree to sink another 1000 feet. In California, the main shaft of the North Star mine at Grass Valley is down 5400 feet on the vein, which has a dip of 28°, so that the maximum vertical depth is only 2086 feet. At the bottom the vein is larger and shows more gouge than on the upper levels; in consequence, more waste is mixed with the ore, reducing the average yield to $12 per ton for a width of 6 feet, as against the 18 inches of $18 ore that was extracted from the upper workings. No defined ore-shoots exist, the mine is becoming less wet, but the prospects of profitable exploitation continue undiminished with increase of depth. The neighboring Empire mine has an incline shaft that is down 3500 feet on the vein but only 1570 feet vertically below the surface. This mine is said to be in a highly productive condition. The Kennedy, on the Mother Lode, in Amador county, is one of the famous mines of California. The maximum depth attained is 3254 feet, with stoping in progress from 2000 to 3000 feet, and an excellent showing at the bottom. The shaft is now being sunk. Speaking in a general way, on the Mother Lode the rich ore found at surface reached to about 300 feet; between that depth and 700 feet there was in many cases, an impoverishment, which was succeeded at 1000 feet with another zone of profitable ore, extending to 1700 feet; then the lode became poor again until about 2500 feet, at which depth a few mines obtained another lease of life. On the Comstock the deepest mining now in progress is on the 2300-ft. level of the Ophir, which is 2552 feet below the Gould & Curry outcrop. It will be remembered that the greatest depth attained on the Comstock was in a winze in the Mexican mine, which, before the flooding of the workings, in 1884, reached down to 3308 feet, or 3554 feet below the Gould & Curry outcrop. On the Rand the shaft of the Cinderella Deep is down to 4200 feet and that of the Jupiter to 4230 feet. Before long Johannesburg will have many deep mines. In Brazil the Morro Velho shaft of the St. John del Rey has reached a depth of 4264 feet. But the deepest metal mines are still in the Lake Superior copper region. There the Red Jacket shaft of the Calumet & Hecla mine is 4920 feet vertical; while the Tamarack has two shafts over 5000 feet deep, namely, No. 5, which is 5180 feet and No. 3, which is 5230 feet vertical. These Tamarack shafts were sunk to extract ore from the copper lode first exploited in the Calumet & Hecla, and they cut a lode having a dip of 38° at a vertical depth of 4660 feet. By attaining a depth of one mile underground and by showing with what ease operations are conducted at that great depth, these Lake Superior mines have demonstrated that man is likely to be able to penetrate at least as profoundly into the earth as the ore persists.—*Engineering News.*

NEW AND HIGH PRICED STEEL RAILS EXPECTED TO PREVENT MANY RAILROAD ACCIDENTS.

After protracted and expensive experimentation an American concern has demonstrated that it can manufacture the best railroad rail the world has ever known. The new product is a nickel-chrome rail, and it is a discovery of the Bethlehem Steel Company. Its price is $51 a ton, the highest in cost in the history of steel manufacture and at the same time the least expensive on account of its durability and other qualities.

The history of the rail is a new chapter in the "romance of iron and steel." It is confidently believed it will be a boon to transportation and a benefit to humanity. With the success that has crowned the efforts of the Bethlehem Steel Company to manufacture a rail that would meet modern demands it is likely that soon reproach will no longer be cast on American that it leads all other countries in train wrecks.

Several years ago criticisms of the railroads became severe because of the frequency of wrecks on account of broken rails. The railroads put the blame up to the manufacturers of steel rails. Criticism reached its climax when the Shriners' special, on account of a broken rail on the Southern Pacific Railroad at Honda, Cal., was wrecked and 21 men and women attached to Rajah Temple at Reading were killed.

HARRIMAN MADE TROUBLE.

Big corporations do not tell of their internal fights, but E. H. Harriman made such trouble about that broken rail that a man who was then slated for the presidency of the United States Steel corporation did not get the position. The man in question was a great railmaker, so far as quantity was concerned.

Headed by Harriman, the railroad men demanded a better steel rail, and the cry for an improved rail was taken up officially by the railroads under the guise of the American Railway Engineering and Maintenance of Way Association.

It was then that Mr. Schwab, principal owner and president of the Bethlehem Steel Company, got busy. He turned a new rail called the "open-hearth" steel rail, which today sells for $6 a ton above the standard price of $28 a ton for the ordinary steel rail. This is a high-grade rail, which many railroads have laid at places where there is unusual strain on the tracks.

Schwab, however, contemplated a rail of a still higher grade, which would be as near perfection as science could make it. The result is the new nickel-chrome rail, whose price of $51 gives an idea of its merit.

RAIL THEORETICALLY PERFECT.

Several months ago such a rail was turned out theoretically perfect. The railroad man most interested in this rail was Harriman. He ordered samples and had stretches of track laid with it. The rails were put to the severest tests with the most satisfactory results. He then told Schwab to proceed with the manufacture of this rail.

In preparation for this Schwab engaged as superintendent of his new rail mill G. L. Sheldon, a young manufacturer, who had won his spurs with the Lackawanna mills at Buffalo. When Schwab left for Europe early in March he gave Superintendent Sheldon full power to use his own judgment in the manufacture of the new rail.

A test run a few days ago was highly gratifying. In a 10-hour shift 825 tons of nickel-chrome rails were turned out, worth upward of $42,000. The skilled men on this special 10-hour run made fabulous wages. One roller cleared $32 or $3.20 an hour. Several others made $30. An engineer, who ordinarily gets $3.50 a day, made $14, and there wasn't a man of the crew that didn't make $1 an hour.

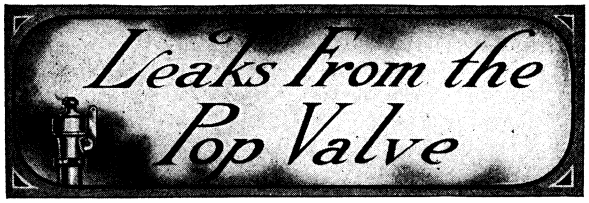
OTHER RAILROADS BUYING.

Harriman ordered the entire output of this shift for the Southern Pacific Railroad and orders for the same kind of rail have since been received from the Delaware. Lackawanna and Western, the Lehigh Valley and other railroads.

There is no secret process in the making of the new rail. It is simply the result of business genius in assembling men "who know" and having facilities to manufacture.

The credit for compounding the materials that go into the nickel-chrome rail is given to Austin Buck, long the chemsit of the Bethlehem Steel Company, whom Schwab lately promoted to the position of general superintendent of the entire plant.

INDEX TO ADVERTISERS.



JUST WHAT HE MEANT.

Josh—Never let yer gal git to be one of thim thar autymobile cranks. She's liable to run off with one of thim chiffoniers.

Bigosh—No, you don't mean a chiffonier. You mean a chaffeur. A chiffonier is one o' thim tall swell dresser things.

Josh—Wal, thim's the very fellers I'm talkin' about.

"Yes", said Mrs. Malaprop, "my boy is doing first-rate at school. I sent him to one o' them alimentary schools, and his teacher says hes' doing fine. He's a first-class sculler, they tell me, and is head of his class is gastronomy, knows his letters by sight, and can spell like one of these deformed spellers down to Washington."

"What's he going to be when he grows up?"

"He wants to be an undertaker, and I'm declined to humor him, so I've told the confessor to pay special intention to the dead languages," said the proud mother.

HOW PAPA SAID GRACE.

A gentleman and his wife, both of whom were greatly respected by their neighbors for their Christian charity, entertained a visiting clergyman from a distant city. Among the guests were members of their own church. A bright little daughter of the host was greatly interested in the good doctor, and very curious to know why people should say grace before eating. The doctor was pleased at the question, and hastened to inform her that all good people endeavored to return thanks in that manner for the good things which were given.

"Yes," exclaimed the little inquisitive, "but you don't say grace just like my papa said last night."

"How was that?"

"My God, what a supper!"—*Clover.*

HOW SAD.

Their meeting it was sudden,
And it was very sad;
She sacrificed her dear young life—
'Twas all the life she had.
She's sleeping 'neath the daisies,
She's resting peacefully now;
There's always something doing
When a freight train meets a cow.

A certain railroad had purchased four new engines and when they arrived at the headquarters of the division over which they were to operate, the old roundhouse foreman who saw to mounting, filling and firing up the new equipment stated to the officials, who were somewhat interested in the new power, that the first engine had too much lead, the second was a hard steamer, the third would reverse with difficulty, and the fourth was deficient in some other way which he specified. The officials were surprised to note that the reports turned in by the engineers after the trip of each engine were exactly as the old roundhouse man had phrophesied and they asked him how he had drawn his conclussions as he had not the time to make so complete an examination as would have been necessary. His reply was, "O, I knew who was going to take them engines out."—*W. L. Park, Gen'l Supt. Union Pacific R. R., before the Western Railway Club.*

The job of toastmaster is not without difficulties. He always has to tell a story and the story seldom has anything to do with the position. The writer heard one not long ago that did, however. The toastmaster said: "I am in the position of that hobo who entered the back yard of a Pittsburg home. He must have been hungry, for he said, 'Lady, if you will give me a lunch I will chop wood for you.' 'But,' said the lady, 'we don't use wood. We use natural gas.' 'All right,' said Dusty. 'Give me the lunch and I'll turn on the gas.' "

"What is this white man's game of billiards that I hear so much about?" said the first Hindoo.

"Don't you know?" said the second.

"No. Tell me."

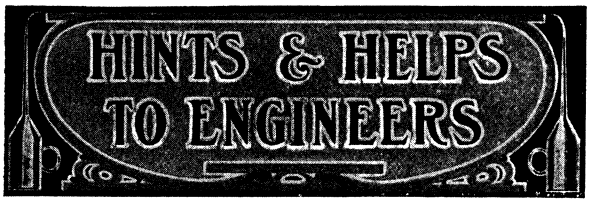
"Well," said the second Hindoo, "billiards is a very simple game. Two men armed with long sticks poke at a ball on a green table, and one says 'D——' while the other says 'Hard lines.' "—*Washington Star.*

The car was hot and dusty, the mother worn with travel, and the child crying—a cure for which he was vainly offering nature's assuasive remedy. Finally, failing to even attract the little one's attention, she said with much earnestness:

"Look heah, chile! Less you done take yo dinnah right now, I'll suah give it to de conductah!"—*Sagebrush Philosophy..*

"I hope, driver, that you will not run away with me."

"Bless yer, no moum! I've got a wife and six kids at home already!"—*Bagology.*



THE INJECTOR AND SOME EMERGENCY METHODS.

The injector was patented by Henri Giffard, eminent French engineer in the year 1858, and the first injector was introduced in this country in 1860 by Wm. Sellers & Co. Today there are many makes of injectors on the market, and if you were to investigate the standard makes it would be a hard matter to distinguish which one particular make had superior points over the other.

Among the standard makes of locomotive injectors are the Metropolitan, Sellers, Monitor, Ohio, Simplex, Nathan, and Little Giant. All of these are the improved self acting type and made along similar lines, so if you understand the workings of one type of injector you can readily understand any other type. The improved self-acting injector in good working order is the most satisfactory boiler feeder which can be used, but there are times when even the best refuses to work. The trouble which causes the injector to refuse to work may not be in the injector itself, in fact it is seldom to blame. Usually the fault is due to careless handling, leaky condition of the steam valves, joints of the suction pipe and hose couplings, or cinders and dirt in tank. It can be readily understood that under such conditions that the injector cannot be expected to perform its regular function. The first indications that any of these conditions exist will be reduced efficiency, and finally refuse entirely to deliver water to the boiler.

It is often difficult to do much in the way of repair to an injector when out on the road, especially if the pipe coupling wrench should be missing, but it should be the duty of every engineer to see that all such tools are carried in tool box on engine as you have no way of telling what minute the injector may fail to work. The majority of the standard makes of injectors are so arranged that the combining and delivery tubes can be removed with ordinary tools, but when it becomes necesesary to take the injector apart owing to leakage from the steam and main check valves it is a very disagreeable task without the proper tools.

Suppose that an injector suddenly stops working, the trouble will probably be with the tubes, hose, section pipe or strainer becoming stopped up. The last two can no doubt be cleared out readily by closing the cam over the overflow valve and drawing the starting lever quickly; if the hose lining has become loose, it will let the steam flow back and close up again as soon as the injector is started, disabling this injector until a short nipple or coiled wire can be forced up the hose or a new hose can be obtained. If, however, water is needed before you can reach point of supplies, the left hand injector must be made to work, unless you stop the train and the injector and pipes are examined thoroughly. Treat the left hand injector the same as the right. Open the tank valve and draw the injector starting lever; if water is lifted but will not enter the boiler, set the lazy cock at half capacity and tap the main check valve on cap with hammer to loosen it in its guide; at half capacity, because at that point the injector gives a higher back pressure than with the lazy cock wide open. This will probably be effective.

If it is necessary to remove the tubes, uncouple the feed pipe from the injector and swing it out of the way; place a monkey wrench on the guide for the line check and unscrew; in some of the older patterns of injectors it may be necessary to insert an old file or flat piece of iron, or perhaps two pieces in opposite openings; at any rate, it can be removed quite easily unless the seats are heavily limed up. This draws out the combining and delivery tubes which can be separated and carefully examined inside; here is where the trouble will usually be found, and the obstruction must be taken out without bruising the surface or bending the tubes. When the parts are replaced, test before recoupling the feed pipe. No steam should issue from suction branch. All of this annoyance and delay has no doubt been caused by the absence of a strainer in the tank, or by the fact that the holes in the straining plate are too large. All these parts should be carefully watched to avoid trouble of this nature. Delays are expensive to your employers and the more efficient service you can give the more salary you can demand.

CARNEGIE MILLS TO RESUME.

Sharon, Pa.—The reed mill resumed operations at the south Sharon works of the Carnegie Steel Co., on Monday, March 8th. The bar and billet mills started on March 11th and the open hearth department resumed March 3rd. All the departments have been idle for 10 months. About 1,000 men will be afforded employment.

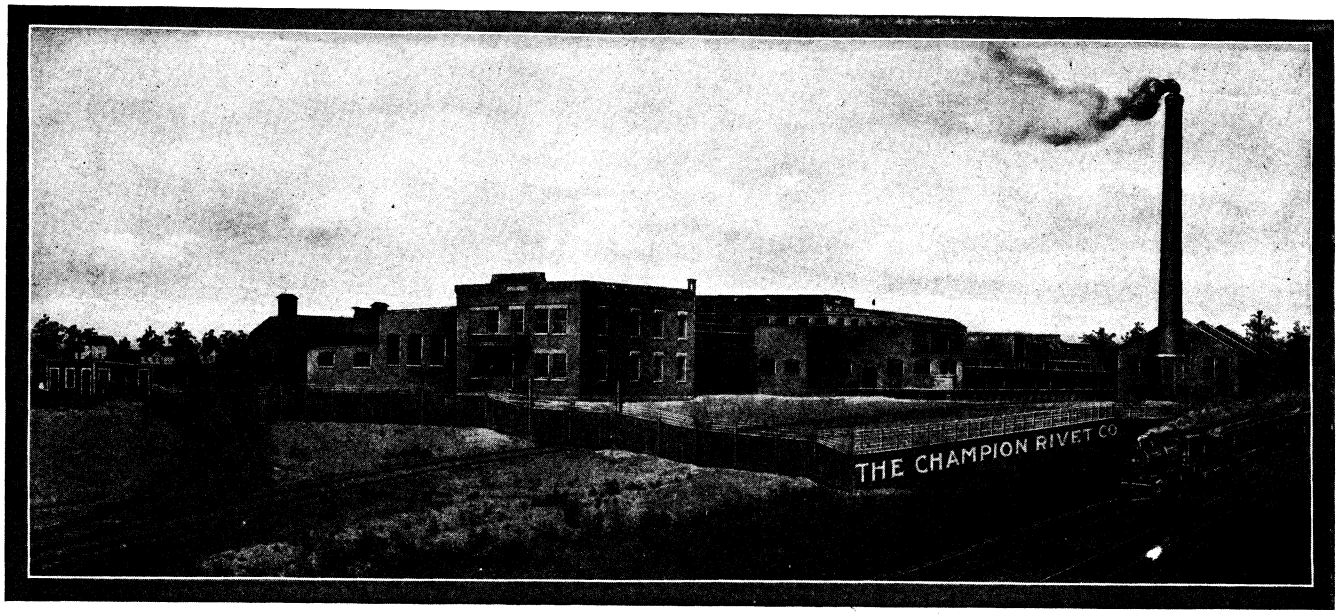
Directory of Railway, Locomotive, Engineering and Mining Journals

Directory of Engineers

Largest Rivet Manufacturing Plant in the World

"Victor" Boiler, Ship and Structural Rivets

COUPLER PINS



AIR BRAKE PINS

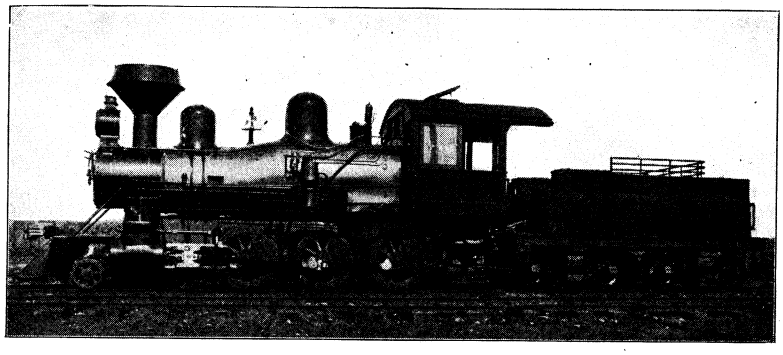
"V" on every head

The Champion Rivet Co., Cleveland, O., U. S. A.

THE LIMA EQUIPMENT COMPANY

LIMA, OHIO

Have this Brand New 12" x 18" 4-6-0-8 Locomotive on hand for immediate shipment. Illustrated below. Write for description.



We also have the following second-hand Locomotives for sale CHEAP

1	15 ton Shay.	42 " Gauge.	Mississippi delivery	No. 0810
1	15 ton Shay.	56½" Gauge.	South Carolina delivery	No. 0818
1	17 ton Shay.	56½" Gauge.	South Carolina delivery	No. 0819
1	18 ton Shay.	36 " Gauge.	Tennessee delivery	No. 086
1	33 ton Shay	56½" Gauge.	West Virginia delivery	No. 0825
1	37 ton Shay.	56½" Gauge.	Alabama delivery	No. 0822
1	65 ton Shay.	36 " Gauge.	New Mexico delivery.	No. 083
1	70 ton Shay	56½" Gauge.	Virginia delivery	No. 0820
1	13 ton 4-Coupled.	56½" Gauge.	North Carolina delivery	No. 0814
1	30 ton Mogul.	56½" Gauge.	Missippi delivery	No. 0823
1	30 ton Mogul.	56½" Gauge.	Missippi delivery	No. 0824
1	35 ton Mogul.	56½" Gauge.	Mississippi delivery	No. 089
1	38 ton Mogul.	56½" Gauge.	Arkansas delivery	No. 0817
1	36 ton Mogul.	56½" Gauge.	Georgia delivery.	No. 085
1	55 ton Mogul.	56½" Gauge.	Texas Delivery.	No. 0821

Write for full information and price on the above Equipment.

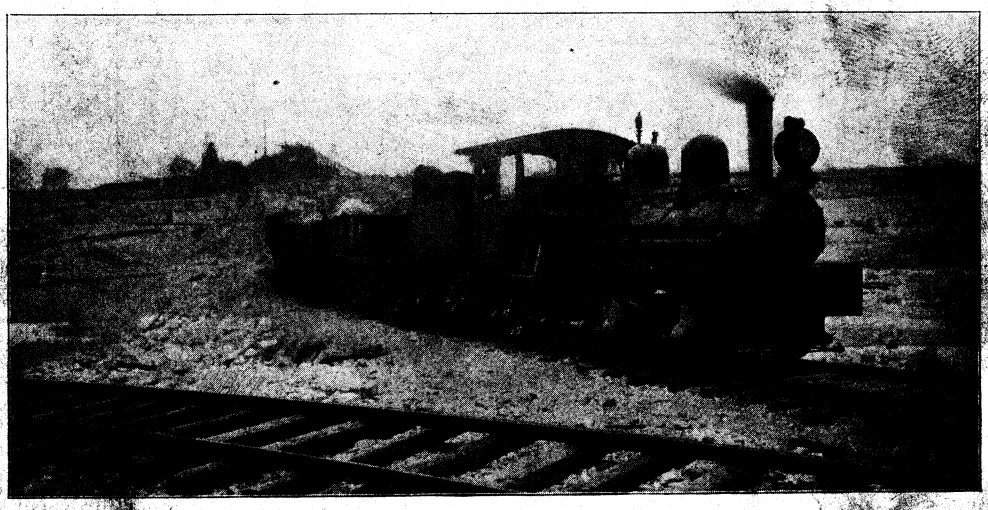
THE LIMA EQUIPMENT COMPANY

LIMA, OHIO

LIMA LOCOMOTIVE

EXTREMELY EFFICIENT

On Steep Grades and Sharp Curves and for Service in Logging, Mining, Industrial, Plantation and Standard Railroads



VIEW SHOWING SHAY AT WORK IN A STONE QUARRY

One of the 4 18-ton Shays owned and operated by The Sibley Quarry Co., Sibley, Mich., whose grades average 5%, and radius of shortest curve is 125 feet. Each locomotive handles 1278 tons per day of 10 hours

AGENTS

NORMAN B. LIVERMORE & CO.
METROPLIS BANK BLDG.
SAN FRANCISCO CAL.

HOFIUS STEEL & EQUIPMENT CO.
SEATTLE, WASH

WOODWARD-WIGHT & CO
NEW ORLEANS, LA.

F. C. WEBB
512 EQUITABLE BLDG.
DENVER COL.

BRANCH OFFICE
BIRMINGHAM ALA.
2028 FIRST AVE.

The Lima Locomotive and Machine Co.

1093 SOUTH MAIN STREET, LIMA, OHIO