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THE LOCOMOTIVE WORLD

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THE LOCOMOTIVE WORLD

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THE FRANKLIN TYPE AND PRINTING COMPANY

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Fuel Economy and Flue Maintenance

ECONOMY in fuel can be effected in a number of different ways. Many articles have been written on this subject and many methods suggested, but regardless of how careful the fireman may be in firing to not crowd the fire, one of the most common reasons for waste of fuel and trouble with flues is improper care of the boiler.

Boilers should be thoroughly washed at frequent intervals and flues scraped and cleaned.

As to just how often the boiler should be washed and methods used, depends on conditions. Mr. J. F. Raps, General Boiler Inspector of the Illinois Central Railroad, in writing on this subject says that the methods used may be conductive of good or bad results, and the following are a few concise rules governing the proper method of preparing and washing the boiler, which he has given:

1. Locomotive boilers are required to be washed as often as may be necessary to keep them clean and free from scale and sediment.
2. Boilers should be thoroughly cooled before being washed at all points excepting where improved hot water washing systems are installed.
3. When there is sufficient steam pressure to work it, start the injector and fill the boiler with water until the steam pressure will no longer work the injector. Then connect water hose to feed pipe and fill boiler full, allowing the remaining steam pressure to blow through syphon cock or some other outlet at top of the boiler. Open blow-off cock and allow water to escape, but not faster than it is forced in through the check, so as to keep the boiler completely filled until the temperature of the steel in the fire box is reduced to about ninety degrees, then open all blow-off cocks and allow boiler to empty itself as quickly as possible.
4. While the boiler is cooling the boiler washer is to loosen all wash-out plugs. All wash-out plugs and arch tube plugs must be removed at every washing.
5. Removing the plugs or opening the blow-off cocks is forbidden until the water coming from the boiler is cooled to 90 degrees. The object of this method is to cool the boiler equally.
6. The crown sheet shall then be washed, starting on sides and then washing through holes in backhead.

7. The door ring to be washed next.

8. Wash arch tubes next. It is very essential that the pneumatic or other cleaner be used every time boiler is washed and all concerned are instructed to strictly comply with these instructions.

9. Then wash through plug holes in barrel of boiler just ahead of firebox, using bent nozzle in order to thoroughly wash down flues. Wash flues through plug holes at front of barrel, using bent nozzle.

10. Wash belly of boiler, starting at front end, using bent nozzle, washing scale toward firebox.

11. Wash legs of boiler through plug holes in side and corner of firebox, using straight nozzle in corner holes and bent nozzle through side holes, revolving same to clean the side sheets. Rods to be used to dislodge any accumulation that water pressure will not move.

12. After boiler is washed out it should be thoroughly inspected through all plug holes before plugs are replaced, to see that no accumulation is left. The work of inspecting should be taken care of by foreman boiler maker or inspector.

13. The removal of all plugs is imperative. The plugs should be put back with a coating of graphite and oil made to a paste. This enables the plugs to be removed readily.

14. Boilers should be washed out with a minimum of 100 pounds pressure.

Mr. Rap further states that "One may take a locomotive with practically a new set of flues, and by the improper use of the injector, cause most of the flues to leak. This can be demonstrated by getting into the firebox after the fire has been drawn and the locomotive has a perfectly dry set of flues, then start either the right or left injector and watch the result caused by the change in temperature of the water around the flues. The engineer and fireman should carefully examine the firebox sheets and flues as soon as they take charge, and if they find the flues are all open, in good condition and there is no mud on the flue sheet, there is absolutely no reason for a failure due to flues leaking. However, there are cases where tonnage is reduced or trains set out, and on making an inspection of the flues, they are found to be in good condition, but loose in the sheet, which is prima facie evidence of the improper use of the injector."

The washing of the boiler will not eliminate the collection of scale and the deposit of sediment entirely, but it is certain that it will retard this formation, to a great extent and increase the efficiency and life of the boiler. The writer has known of boilers where the collection of sediment in the water legs was allowed to go on until the water space in the lower part of the water legs was filled at least twelve inches up from the mud ring. Further this deposit or sediment had hardened so that it was practically solid and had to be dug out when repairs to firebox were made. This was sure proof that this boiler had not been given the proper attention as far as washing was concerned.

The scale in a boiler is a very poor conductor of heat, as it has been shown by experiment that its conducting power compared with that of iron is something like 1 to 37. You can, therefore, readily appreciate what would be the result in fuel economy if the boiler can be kept free from scale.

It should be remembered by every user of a locomotive that the boiler is what produces all the power, as without the boiler you have no steam and without steam the cylinders will not move the drivers. Consequently, anything that incapacitates the boiler of its efficiency and prevents it from performing its full duty causes loss. Loss of power, likewise loss of money.

Illinois Central Prospering—Officers and Directors Order Cars, Engines and Rails to Handle Growing Traffic

President C. H. Markham of the Illinois Central Railroad, while at Birmingham the other day with some of the directors and other officers of the system, remarked that business over the lines of the company had so increased that he believed by the first of the year it would be able to make as good a record as it did two years ago. As an illustration of the confidence which was felt in the future he called attention to the fact that an order had been placed for 40,000 tons of steel rails, of which 20,000 tons will be rolled in the Birmingham district, and furthermore, 50 locomotives have been ordered for the Illinois Central Railroad and 8 for the Central of Georgia Railway; also 2000 cars for the former and 1000 for the latter.

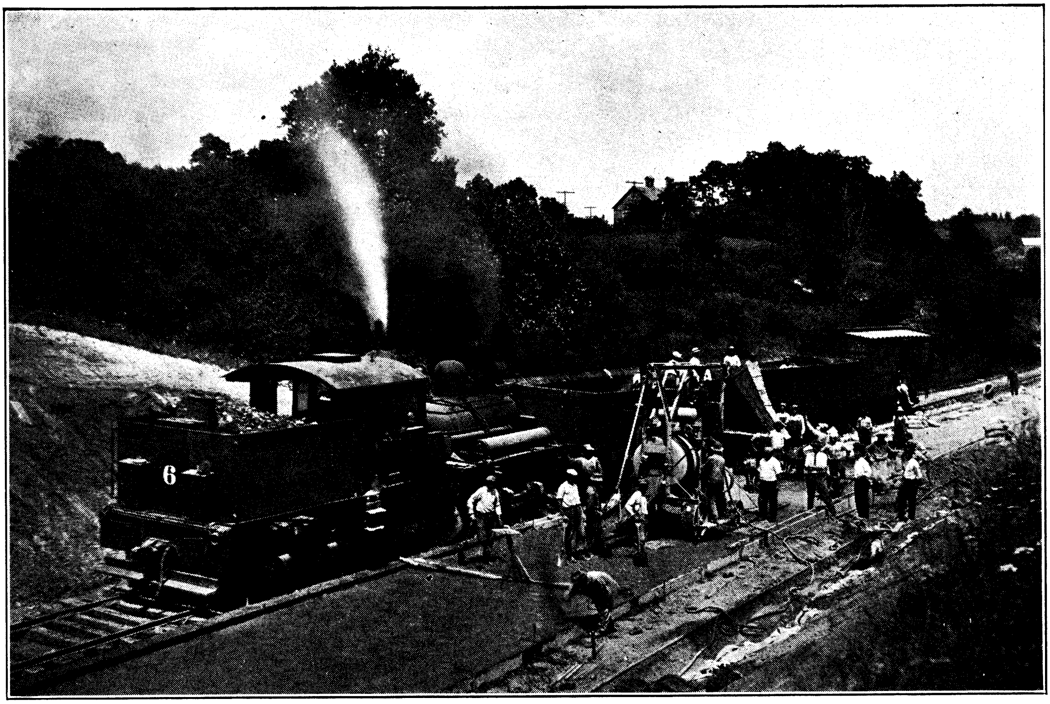
In the party with Mr. Markham were six members of the directorate, besides several of the other officials from Chicago. They traveled in a special train. All of them were optimistic concerning business conditions, expressing the belief that good times had come to stay, and that they would grow better daily.
—*Manufacturers Record.*

Build Standard Gage Railroad to Haul Road Materials.

Low Cost Per Ton-Mile Obtained at New Lexington, Ohio, by Bringing Freight Cars Directly to the Job.

ALL MATERIALS, consisting of 1000 carloads of screened gravel, sand, cement and brick for 6.1 miles of 16-ft. brick road, with a concrete foundation, now under construction at New Lexington, Ohio, are being hauled directly to the job in railroad cars without rehandling. A 50 ton geared steam locomotive is used to pull the cars over a spur built entirely upon new right-of-way. The track, which is standard gage, is constructed with 60-lb. relay rails. Sixty per cent of the ties are railroad unspiked discards and are used only to furnish bearing. The remainder are standard ties which hold the gage.

Some trouble was anticipated, due to the possibility of the track settling on new fills. As a result the ties on the fills were spaced closer and 3 or 4-in. saplings were placed under the ties parallel with the rails. However, the fills are few and all are short. The track is laid just outside the limits and parallel with the curb of the new road. A number of 4, 5 and 6 per cent grades are encountered.



THIS METHOD OF HAUL COST THE CONTRACTOR 12 CENTS PER TON-MILE

OPERATION OF MATERIAL TRAIN

For the concrete work a train consisting of one car of screened gravel, one car of sand and one of cement is kept moving alongside the Koehring paving mixer. The original intention was to use a tank car for hauling water for the concrete work, but owing to the heavy grades it was decided to pipe the water and thereby relieve the work of the locomotive.

The gravel car is spotted directly opposite the mixer. A batch hopper is hung on the side of the car and is loaded while the mixer skip is discharging into the machine. When the skip is lowered to the ground a gate in the batch hopper is opened and gravel is shot into the skip. The sand car is pushed ahead

Total and Ton-Mile Hauling Costs

First cost		
New hardwood ties, 4000 at 32 cents	$1,280	
Old ties from railroad, 12,000 at 10 cents	1,200	
Relay rail, 60-lb., 550 tons at $17	9,350	
Labor laying and removing track, 32,000 ft. at 15 cents	4,800	
Locomotive	4,500	
		$21,130
Operation 8 months at $250		2,000
		23,130
Salvage		
Scrap rail, 550 tons at $13	$7,150	
Locomotive	1,500	
		8,650
Net cost		$14,480

1000 cars, or 40,000 tons hauled an average of 3 miles equals 120,000 ton-miles. Cost per ton-mile 12 cents.

of the gravel car, and sand is unloaded through a chute into wheelbarrows. The cement is unloaded from the cement car and distributed along the line of the work. One man is kept busy dumping cement into the skip.

The cars of brick are unloaded by carriers and laid directly from the car. The accompanying photograph clearly portrays the concrete train at work on the job. High speeds are not needed and considerably fewer trips were necessary than with other common methods of transportation.

The foregoing table indicates a haulage cost of 12 cents per ton-mile. The contractors are Swank & McIntyre of Dayton. —*Engineering Record.*

A BIG BOOST FOR THE SYCAMORE.

The Largest of Broad Leaf Trees and the Best for City Planting, so Govern-Foresters Declarement

That the largest shade tree in the United States, as brought to light by the prize contest held by the American Genetic Association, should turn out to be the Eastern sycamore is not surprising, in the opinion of Government foresters, says a recent report of the Forest Service. The sycamore has long been regarded as the largest deciduous tree in North America, and its range of growth is hardly second to that of any other broadleaf tree; for it can be found from Maine to Florida, and as far west as Kansas.

The bestowal of the prize on a sycamore at Worthington, Ind., which is 42 feet 3 inches in circumference and 150 feet tall, draws attention to the fact that foresters are nowadays especially recommending the species for city planting. They say that long experience with sycamores planted in city streets has shown that the species is peculiarly able to withstand the smoke, dust and gases which are usually an unavoidable complement of urban life. In addition, the sycamore is as resistant to attacks of insects and fungi as almost any species, and is a quick grower. At 10 years of age a healthy sycamore usually is already large enough for shade as well as for decorative purposes. As for the latter, there is hardly any Eastern tree which is generally held so picturesque as the sycamore. With its strikingly mottled bark and magnificent stature and conformation the sycamore has a marked individulaity and cannot be mistaken for any other species, either in the summer, when the foliage conceals its structural form, or in the winter, when the leaves are absent.

A common objection to the sycamore as a lawn tree is its habit of dropping its leaves before autumn. From this characteristic it is sometimes called a "dirty tree". Recently the Forest Service received a letter from a suburban resident who has a sycamore on his lawn. "My sycamore tree is very beautiful," said the writer, "until about the first of August, when its leaves begin to fall. Is there any remedy that I can apply to the tree to keep it from dropping its leaves so soon?" It was necessary to tell the correspondent that this was a characteristic habit of the tree. This drawback, however, is practically the only failing that the sycamore has, and it is offset by many desirable qualities.

Foresters say that the chestnut and the black walnut are the largest nut-bearing trees in this country, and the contest did, in fact, unearth a chestnut near Crestmont, N. C., which is 33 feet 4 inches in circumference and about 75 feet tall.

The contest brought forth photographs and authentic descriptions of 337 trees in all parts of the United States, making a distinctly valuable contribution to existing knowledge of native trees. It was found that, in all probability, there is no living elm larger than

"The Great Elm" at Wethersfield, Conn., which is 28 feet in circumference and about 100 feet tall, and is estimated to be 250 years old. Many remarkable specimens of species which ordinarily attain only small sizes were unearthed by the contest, furnishing new records of maximum growth. A sassafras was brought to light at Horsham, Pa., which is 15 feet 10 inches in circumference at four feet from the gound, whereas, for example, not long before this a Georgia town claimed that it had the largest sassafras tree in the world, though this tree was only something over seven feet in circumference. A white birch was found in Massachusetts with a girth of 12 feet 2 inches; a pecan was found in Louisiana with a circumference of 19 feet 6 inches, and a catalpa in Arkansas with a girth of 16 feet. The tallest tree found is a yellow poplar in North Carolina, which is 198 feet high and has a circumference of 34 feet 6 inches.

The value of the contest lies in its contribution of new information as to the maximum growth attained by deciduous species and the localities in which the different species seem to grow best. The relative sizes of the coniferous species are fairly well established, the Bigtree of California, for example, being the largest in the world; but information on the size attained by deciduous trees in this country has been very incomplete.—*Manufacturers Record.*

Staybolts

By Geo. L. Price

At present three kinds of staybolts are being used in locomotive boilers—the rigid, the hollow and the flexible bolt. Staybolt breakage has been eliminated to a great extent since the introduction of the flexible bolt. In fact, staybolt breakage and the remedies for eliminating breakage have been live topics of discussion for many years.

Years ago expansion and contraction were not taken care of by the use of flexible bolts, but an attempt was made to restrain the expansion and contraction by the use of heavy sheets, large staybolts, heavy bracing, etc. Before the flexible staybolt put in its appearance, the rigid bolt, threaded on both ends and riveted over, was made from a solid bar of iron of the best quality, but, nevertheless, led to breakage regardless of all modifications in form, shape and size, with additional changes in quality to strengthen the bolts. From this it is natural to conclude that it is not so much a question of quality in the material as it is a question of too much rigidity in construction.

FLEXIBLE STAYBOLTS

The flexible staybolt has proved a large factor in the elimination of inequality of expansion in locomotive boilers. It is impossible to restrain or restrict the expansion of material without disturbing its structure. A rigid staybolt under normal conditions, considering the tensile strength and the stress under pressure, has a large factor of safety, but, owing to the vibratory stresses due to the expansion and contraction of the firebox sheets, and due to the fact that the bolt being threaded opens an avenue for a fracture which will result in a break, the rigid staybolt has always given a great deal of trouble.

I have often been asked the question, why is it that a rigid staybolt generally breaks flush with the inner surface of the outside sheet? While I have never seen anything authentic in regard to this, the following reasons seem to me to be logical: As the inner firebox sheets are generally about one-half the thickness of the outside sheets, they become heated before the outside sheets and start to expand first, thus causing the inner, or firebox, end of staybolt to travel in the direction of the stress, while the outside end of the bolt, which is at a lower temperature and is held more rigidly, moves only a comparatively small amount at first, but eventually travels a greater distance than the inner sheet, owing to the fact that the outer sheet is a larger and thicker sheet, and consequently expands a greater amount when the temperature is increased. The continuous vibration upon the staybolt, together with the tensile stress, or load, due to the pressure on the bolt, will eventually break the staybolt. Breakage in this way generally takes place when the engine is being fired up after a washout, therefore it is logical to believe that the hot water system of washing out would lessen the breakage of rigid staybolts.

Staybolts not only act as a connecting agent to hold the outer and inner firebox sheets together against boiler pressure, but they are also compelled to withstand excessive bending stresses, set up by the unequal expansion and contraction of the inner and outer sheets. The load upon a staybolt, due to the boiler pressure, is comparatively small as compared to the stress induced by the inequality of expansion and contraction.

STRENGTH OF STAYBOLTS

The strength of a staybolt should be calculated from its smallest area. Staybolts are made from wrought iron on account of its fibrous structure, which will stand more abuse from the different stresses acting upon the bolt than will steel, which is of a crystalline structure. All staybolts become more or less crystallized by the rapid blows of the hammer in riveting, although it is impossible to judge the amount of crystallization occasioned by the riveting process.

Inferior installation of flexible staybolts often gives us considerable trouble. We have been calking the flexible bolt thimbles or bushings in the roundhouse for the last three years, and, furthermore, we have not finished calking yet, and probably will not have finished until we have gone over the entire lot of bolts. We may attribute this defect to inferior installation during the construction of the boiler in the locomotive works. This is an expensive item for our railroads to contend with, and it should be eliminated.

APPLICATION OF FLEXIBLE BOLTS

When applying flexible staybolts, the adjustment of the bolts should be taken into consideration, although this is not uniform for all types of boilers. When firing up a locomotive boiler, the inner firebox sheets expand more rapidly in an upward diagonal direction than the outer sheets. As steam is raised to its working pressure the outer shell expands in a direction which extends longitudinally to a greater extent owing to its larger dimensions and greater thickness. The difference in the amount of expansion between the sheets varies in different types of boilers and, for this reason, bolt adjustment should be based upon data obtained by tramming the firebox for the difference in sheet expansion. However, the writer is of the opinion that the following course of adjustment is adaptable for fireboxes 8 feet long and under:

ADJUSTMENT FOR SIDE SHEET AND BACK HEADS

Taking into consideration the first, second and third outside rows and the same across the top, the bolts in row No. 1 should be given a half turn back; those in row No. 2, three-eighths of a turn back, and those in row No. 3 a quarter of a turn back. For fireboxes 8 feet in length and over, the bolts in row No. 1 should be given three-quarters of a turn back; row No. 2, one-half of a turn back; row No. 3, three-eighths of a turn back.

For the adjustment of the throat sheet, taking the first three rows above the mudring the first row above the mudring should be tight; the second row, three-eighths of a turn back; all other rows, three-quarters of a turn back.

When large areas are covered by flexible staybolts, all bolts inside of the three outside and the three top rows should be turned back off of their seats one-eighth of a turn, because riveting has a tendency to draw the bolt up to its seat.

Staybolts should have a larger factor of safety than the boiler shell or plates, on account of its being subject to both a direct and an indirect pull, as well as an unequal vibratory stress. For this reason I do not think it is practical to admit staybolts in the rivet line when applying a patch to firebox sheets.

EXAMPLES

What load is carried by a staybolt when the bolts are spaced 4 inches between centers and there is a steam pressure of 150 pounds per square inch? The load carried by the staybolt is equal to the area it supports multiplied by the steam pressure per square inch, which, in this case, will be $4 \times 4 \times 150 = 2{,}400$ pounds. This is, of course, disregarding the area of the bolt itself.

If we allow 6,000 pounds stress per square inch for staybolts, what area would a staybolt support, the least diameter of the bolt being ⅞ inch and the allowable working pressure 200 pounds per square inch? First determine the area of the staybolt as follows:

$$.7854\ (.875)^2 = .6013.$$

Then multiply the area of the staybolt by the allowable stress per square inch, and divide the result by the allowable working pressure, giving the area as follows:

$$\frac{.6013 \times 6{,}000}{200} = 18.03$$

Finally extract the square root of the quantity representing the area, and you will have the spacing or pitch of the staybolts:

$$\sqrt{18.03} = 4.25, \text{ or } 4\tfrac{1}{4} \text{ inches.}$$

What force will a staybolt resist whose smallest diameter is ¾ inch, the diameter at the root of the thread being ⅞ inch, with a $\frac{3}{16}$ inch telltale hole, and the allowable working stress 6,000 pounds per square inch? First the area at the root of the threads must be determined. From this value deduct the area of $\frac{3}{16}$ inch telltale hole, or $(.875)^2 \times .7854 - (.1875)^2 \times .7854 = .5737$ square inch.

The area of the staybolt at its ¾ inch diameter will be $(.75)^2 \times .7854 = .4418$ square inch. The area for the ¾ inch diameter being less than the area at the root of the thread minus the area of the telltale hole, the load allowed is computed from the ¾ inch diameter and is: $.4418 \times 6{,}000 = 2{,}650$ pounds.

(continued on page 9)

City Switching Service With Shay Locomotives

THE switching at industry tracks is one of the troublesome features in railway terminal service, due to the limited space available for sidings and connections. This necessitates the use of very sharp curves, which may be combined with steep grades in cases where the industry tracks are above or below the main-track level. The conditions are specially severe in the comparatively few cases where industry service is given to the business districts of large cities. The Kansas City Southern Ry. meets conditions of this kind at Kansas

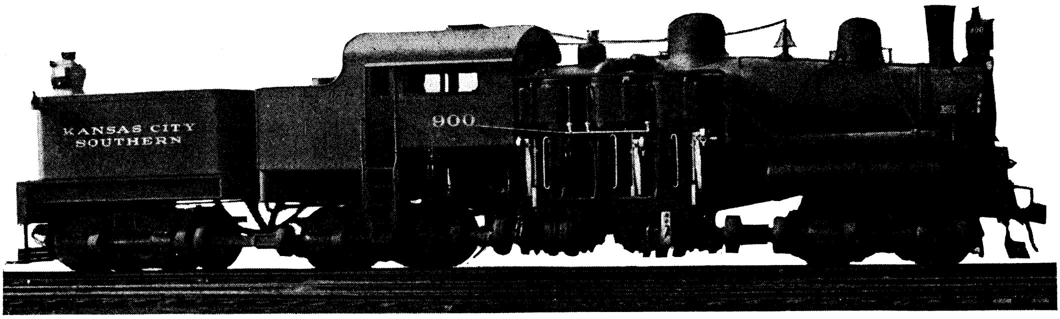


FIG. 1. 190-TON GEARED LOCOMOTIVE FOR SWITCHING SERVICE ON 7% GRADES AND 60° CURVES; KANSAS CITY SOUTHERN RY.

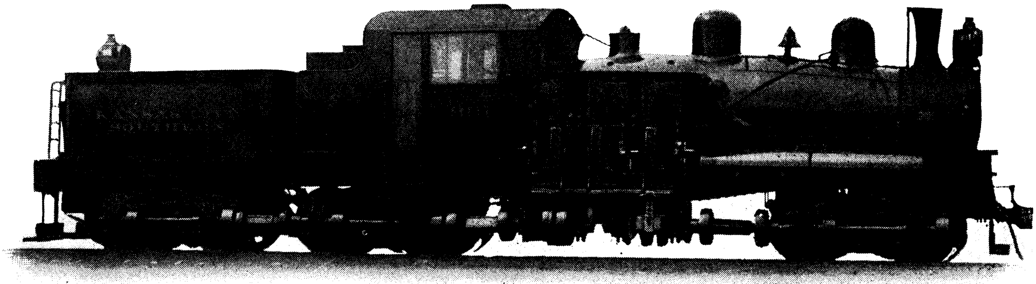


FIG. 2. 140-TON GEARED LOCOMOTIVE FOR SWITCHING ON 7% GRADES AND 60° CURVES; KANSAS CITY SOUTHERN RY.

City, Mo., where its industry connections include depressed tracks leading into the basements of large establishments, and for this service it is using geared locomotives.

This industry service is an important feature both to the railways and the shippers, and the Kansas City Southern Ry. has made special endeavor to give such service to warehouses and wholesale houses, etc., within the business district. The fact that the railway can deliver cars at these establishments is an aid to it in securing traffic, while for the shipper it means the advantage of eliminating all team service to and from the freight houses and team yards. The section of the city thus served is accessible from the freight terminals only by streets having very heavy grades (about 7% maximum), which involved very heavy expense for teaming.

From the railway company's terminal a main industry track leads up to a steep grade and along the side of a street in the warehouse district and has branches laid along alleys. From the main-track lead sidings which occupy sidewalk space and run into the basement levels of the building (the siding being parallel with the main track but on a descending instead of ascending grade). From the alley lines, spurs lead into the various establishments, no cars being allowed to stand in the alleys.

In this wholesale district, no objection is made to the occasional interruption of sidewalks. The railway company paves and maintains the paving along its tracks. Turnouts are placed where needed and where they are likely to be needed in future, so as to avoid tearing up paving and tracks. These turnouts have their rails riveted to steel ties (of 8 in. channels) embedded in concrete, thus making a substantial and permanent construction.

There is a considerable amount of industrial work on grades varying from 0.5 to 6.6 and even 7%, and on curves of 16° to 48°. The operation of switching service under such conditions is apt to be dangerous, particularly when the tracks are greasy or covered with ice or snow. In fact the ordinary engines sometimes could not be operated on the maximum grades, but with the geared locomotives there is no trouble in operating in any kind of weather. A special advantage of these engines is the absence of the noisy exhaust of ordinary engines operating on steep grades, which noise (and the accompanying discharge of cinders and sparks) would be highly objectionable in a city district.

The worst conditions are a combination of 7% grade with a 48° reverse curve having a tangent 34 ft. long. Other 7% grades have 60° curves (not compensated). The length of maximum grade is 1050 ft. Under these conditions, the ordinary switching locomotives of 34,000 lb. tractive power could handle only two cars, and similar engines having sufficient power to handle six or eight cars would be too large and too long to be operated under such track conditions. Two geared locomotives were purchased for this industrial service, but are now used also in general switching work. Their transfer work covers a distance of seven miles, and the industry work covers a territory of about ten blocks. They can push or pull trains of four to eight cars on the severe grades and can control them without the use of the brakes on the cars. Owing to the way in which these engines run in and out of the "holes," they are known among the switchmen as "alley rats."

The engines are of the Shay type, having a vertical inverted engine at one side of the firebox, with its crankshaft connected by intermediate shafts to a shaft on each truck. These last shafts carry bevel pinions (20 teeth) engaging with bevel gears (49 teeth) on the faces of the wheels. Each engine has three four-wheel trucks; one under the boiler, one under the cab and the rear bunker (for oil fuel), and the third under an independent (but power-driven) tender or water tank.

The larger engine, shown in Fig. 1, weighs (with driving tender) about 190 tons in full working order, has 74,400 lb. tractive power and will push or pull a train of 250 tons up a combination of 7% curve and 60° curve (not compensated) at a speed of 4 mi.p.h. The smaller engine, Fig. 2, weighs about 140 tons, has 59,800 lb. tractive power, and is designed to handle a train load of 170 tons on a 7% grade, and to pass, with its train, a 48° reverse curve with 34-ft. tangent and tracks spaced 13 ft. c. to c.

The leading dimensions of the larger engine are given in the accompanying table. The locomotive is practically a double-truck machine with power-driven tender, and the boiler and rear bunker are carried by two heavy fish-belly frames. The engine being at one side of the locomotive, the center line of the boiler is offset from that of the track. On the right side (carrying the engine) the frame is 2 ft. 9½ in. from the center of track, while on the left the distance is 5 ft. 3½ in. The engines were built by the Lima Locomotive Co., of Lima, Ohio. For information we are indebted to C. E. Oakes, Mechanical Engineer of the Kansas City Couthern Ry.; A. N. Reece, Office Engineer, and C. W. Streeter, Superintendent of Terminals.

190-TON GEARED LOCOMOTIVE FOR SWITCHING SERVICE—KANSAS CITY SOUTHERN RY.

Driving wheels (3 trucks), 12	4 ft. 0 in.
Wheelbase, truck (and rigid)	6 ft. 0 in.
Wheelbase, engine	36 ft. 4 in.
Wheelbase, total	53 ft. 4½ in.
Weight on front truck	128,900 lb.
Weight on intermediate truck	138,820 lb.
Weight on tender truck	114,150 lb.
Weight of engine (2 trucks)	267,720 lb.
Weight of engine and tender	381,870 lb.
Weight of engine, light	209,500 lb.
Weight of tender, light	71,700 lb.
Cylinders (3), vertical	18x20 in.
Valve gear	Gooch

Boiler, diameter at first ring	5 ft. 7⅜ in.
Boiler, rail to center line	8 ft. 7 in.
Firebox, size inside	10 ft.x5 ft. 8½in.
Firebox, height, front	6 ft. 5⅜ in.
Firebox, height, back	5 ft. 11⅜ in.
Tubes, diameter, 2 in.; length	16 ft. 0 in.
Heating surface, tubes	2890 sq.ft.
Heating surface, firebox	208 sq.ft.
Heating surface, total	3098 sq.ft.
Grate area	57 sq.ft.
Fuel (oil), in engine bunker	2200 gal.
Water, in tender	5000 gal.
Length over couplers	64 ft. 7½ in.
Width over running boards	10 ft. 10½ in.
Height, rail to top of smokestack	15 ft. 0 in.
Tractive power	74,400 lb.
Gear ratio	49 to 20

—*Engineering News*

(continued from page 6)

THE HAMMER TEST

Boilers are sometimes put under pressure of from 40 to 50 pounds per square inch to aid the inspector in locating a broken staybolt with the hammer. Putting the pressure on the boiler causes the two parts of the broken staybolt to separate, thus permitting the broken staybolt to be more readily found.

All staybolts, crown-bolts and radial bolts should be placed so as to be at right angles or 90 degrees to the sheet they support. When the pitch of the staybolts is excessive, the pressure will bulge the sheets and thus create a deformation.

Staybolts should project beyond the sheet about two threads to form a head in driving the bolt. Excessive allowances make it difficult to upset the staybolt in the hole. The smallest size staybolt advisable for high-pressure boilers is ⅞ inch diameter.

In the distribution of staybolts and braces, every effort should be put forth to distribute them so that each staybolt or brace will have the same working stress per square inch; that is, as nearly so as practicable. In arranging staybolts, attention must be paid to the size of the staybolt, the pitch and the thickness of the plate it supports. It may be possible that the staybolt or brace will be large enough to support the area allotted to it, but the plate may be so light that the pitch will be excessive and cause deformation of the plate. In deciding upon the pitch it is necessary to know for this purpose.—*The Boiler Maker.*

THE CENTRAL OF GEORGIA, as stated in a recent issue ordered 8 Mikado type locomotives and 4 Pacific type locomotives from the Lima Locomotive Corporation. The Mikado type engines will have the same principal dimensions as those ordered by the Illinois Central. The Pacific type locomotives will have 23 by 28 in. cylinders, 69 in. driving wheels and a total weight of 222,300 lb.

THE ILLINOIS CENTRAL, as stated recently, has ordered 47 Mikado type locomotives from the Lima Locomotive Corporation, all of which will have 27 by 30 in. cylinders, 63 in. drivers, tractive power 51,630 lb. a total weight in working order of 284,400 lb. The 3 Santa Fe type locomotives, ordered from the American Locomotive Company, will have 29 by 32 in. cylinders, 63 in. driving wheels, a weight on driving wheels of 274,000 lb., a tractive effort of 67,173 lb. and a total weight in working order of 346,000 lb.—*Railway Age Gazette.*

THE CINCINNATI, INDIANAPOLIS & WESTERN was incorrectly reported in last week's issue as having ordered 42 locomotives from the Lima Locomotive Corporation. The company placed orders for but 35 locomotives, the order having been divided as follows: Lima Locomotive Corporation, 8 Mikado type and 7 six-wheel switching locomotives, and the Baldwin Locomotive Works, 10 ten-wheel and 10 Consolidation type locomotives. —*Railway Age Gaeztte, Nov.* 12, 1915.

Correction

In article entitled "The Injector" Page 5 our October issue there was a tpyographical error in the first paragraph top of page right hand side. This paragraph should read as follows: Water from bottom of a pipe 230 feet high would rush out at a speed of 123 feet per second, that is equal to no less a pace than 83 miles per hour.

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***

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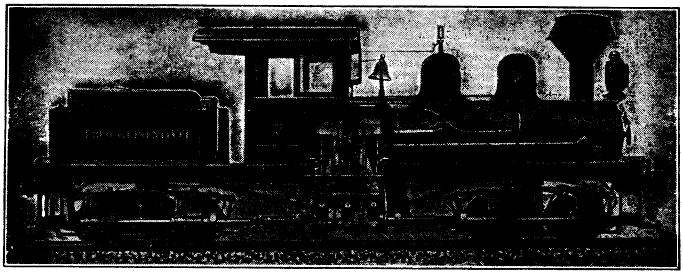

This Locomotive is built for 56½″ Gauge

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1	65	Shay	36 ″	New Mexico	083
1	65	Shay	56½″	New Mexico	0831
1	40	American	56½″	Alabama	134
1	24	Shay	42 ″	Pennsylvania	138
1	24	Shay	36 ″	Pennsylvania	0138
1	30	Shay	56½″	Pennsylvania	139
1	42	Shay	56½″	Louisiana	140
1	50	Shay	56½″	Wisconsin	141
1	45	Shay	56½″	Vermont	142
1	32	Shay	56½″	New Hampshire	143
1	28	Shay	56½″	New Hampshire	144
1	23	Shay	56½″	New Hampshire	146

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