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Contributions.

The Hudson River Tunnel.

TO THE EDITOR OF THE RAILROAD GAZETTE:
 After perusal of your article on the North River Tunnel [Aug. 30], I am unable to tell whether the tunnel is 24 ft. wide and 22 ft. high or 22 ft. wide and 24 ft. high; or how far the centre of the "pilot" is below the roof; or whether there is an invert of masonry; or whether the steel plates referred to form a permanent interior lining of the tunnel, or occupy a position between the brickwork and the silt, or simply serve as centres and are removed when the arch is keyed. Nor do I understand your statement that the "pilot" projects into the undisturbed silt. How can the "pilot" project into the silt, without disturbing it?

It is related that, on one occasion, a clerk in the Treasurer's office at Washington wrote, with much self-satisfaction, an elaborate letter of description, in answer to some inquirer for information, and took the letter for approval and signature to Mr. Spinner, the then Treasurer. Mr. Spinner read the composition carefully; and then, looking up over his spectacles, said: "Yes, this is all very fine; but what does it mean? Young man, whenever you write a letter, phrase it as if you were addressing a d—d fool."

ONE OF THE FOOLS.

[It was not our aim to minutely describe the method of building, since that has been frequently and thoroughly done. We merely wished to recall to the minds of our readers the principal features of the work. The excavation measures about 24 ft. in height by 22 ft. in width; the inside measurements of the tunnel are 18 ft. high by 16 ft. wide; the masonry being 30 in. thick. The dimensions of the excavation are apt to vary a little according to the nature of the material passed through. There is no rule fixing the position of the pilot—sometimes its axis coincides with that of the tunnel, and sometimes it may be a little above or below. There is of course a masonry invert. The steel plates form a shell, which is braced as may be necessary by struts resting against the pilot. A cross section then has the appearance of a big and disproportioned wheel having the pilot for a hub, the struts for spokes and the shell of plates for a tire. The shell is between the silt and brickwork, which is laid within the shell.—EDITOR RAILROAD GAZETTE.]

Transition Curves.

TO THE EDITOR OF THE RAILROAD GAZETTE:
 SHANGHAI, July 31, 1889.

In some of your recent issues letters have appeared relating to a subject which crops up from time to time in all engineering periodicals, thus proving that many of our young engineers are still in doubt about it. I allude to the question of the best method of introducing an easing curve on a railway at the junction of a curve and a straight.

I believe much the easiest and most satisfactory method is as follows: If two straight lines *A B, C B*, fig. 1, have to be joined by a curve, instead of setting it out so as to touch these lines, set it out so as to touch two auxiliary tangents parallel to these lines. The distance of each of these auxiliaries from the straight should be one-third of the amount by which the particular circular curve to be used diverges from its tangent in a distance of 100 ft. If the curve is a one-degree curve (for chords of 100 ft.) its offset from the tangent in 100 ft. is 1.74 ft., and the auxiliaries should be set out 7 in. from the main straight, and so in proportion, 14 in. for a two-degree curve, 21 in. for a three-degree curve, etc. This is all that has to be remembered, and I need not refer to the formula to be

used when the radius of the curve is given in chains and the chain of 66 ft. is used in setting out, as this method is, I believe, little used in America.

There is, of course, no more difficulty in working from the auxiliary straight than from the main straight. If, instead of joining two straight, it is simply desired that a certain

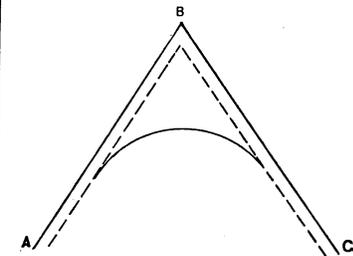


Fig. 1.

curve be started at a certain point, set out the auxiliary as before and start from a point in it opposite the given point on the main straight.

The easing curve is introduced as follows:

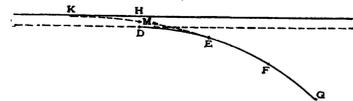


Fig. 2.

D E F G, fig. 2, are stakes in the circular curve, 100 ft. apart. *H* is a stake in the main straight opposite *D*. The stake *K* is in the straight, 100 ft. back from *D*. Insert the stake *M* half way between *H* and *D*, and the work is done. The points *K M E* are points in a cubic curve, which is tangential to the straight at *K*, and to the circular curve at *E*. Its radius of curvature at *K* is infinite, and the outer rail therefore requires no cant or superelevation at that point, while the necessary cant increases up to the point *E*, where it is equal to that required for the circular curve; and as this length is 200 ft., a cant of 6 in. makes the one rail be inclined to the other at an angle of 1 in 400.

It is seldom necessary to give intermediate points, because the plate-layer will always put in an easy curve if he is allowed room to do it, but if intermediate points are required as, for instance, in a tunnel or at a station, where masonry has to be built, they are easily given, as the offset at any point to the curve from the straight (in this case the main straight, not the auxiliary.) is proportional to the cube of its distance from the stake *K*.

This method is theoretically and practically perfect, and my experience is that it gives no trouble whatever. The method is old, but the original system, by which a different length of easing curve was given to each circular curve, was so complicated that it was but little used.

I must not occupy your space by a general dissertation or setting out, but I may be allowed to remind young members of the profession that if they wish to adopt this or any other system, they must use it in the original setting out. If this is not done, the easing curve cannot be introduced afterward in the case of quick curves, where, of course, it is most wanted. The stakes *H* and *D* should be preserved as long as possible for reference, and their position in important cases can be marked by driving two stakes in line, one on each side of and clear of the work, and noting the distances from them with a steel tape.

G. JAMES MORRISON

[As Mr. Morrison intimates, this method is old and it must be well known. It has been explained before in the *Railroad Gazette*, once at least, several years ago. It is, however, so simple that it is practically useful and should be familiar.—EDITOR RAILROAD GAZETTE.]

The Return of Claimants' Bills of Lading.

PHILADELPHIA, Sept. 17, 1889.

I have read your comments upon the claim rules of the Southern Railway and Steamship Association, Aug 23, and the letter of "Merchant," Aug. 30, and am a little puzzled as to the application of the fable appended by you to the latter.

Had "Merchant's" query been given me to answer, I should have found no difficulty in satisfying him. The reply would have been simply that it is not true, and here I beg leave to disclaim any discourtesy. I have no doubt that "Merchant" thinks the facts are as he states, and doubtless some railroad agent has declined to detach his bill of lading or freight bill from the papers of claim temporarily in his care, but if "Merchant" had applied to the General Freight Agent or the Freight Claim Agent for the return of his papers he would certainly have received them. In other words, it is customary with all railroad companies to hold original papers furnished by the claimant as a sacred trust, to be returned upon demand should the claim not be allowed.

You can readily see that it would be improper to authorize any employe to detach and return these documents.

This must be done by or under the orders of the officer in charge of the department of claims.

And now will you kindly say why you think the demand of a railroad company to retain possession of the original bill of lading upon payment of a claim "is simply asking to be humored in clumsy business methods?" A bill of lading is a receipt for the consignment given by the carrier—it should be taken up upon the delivery of the merchandise to the consignee and be filed to show such delivery. If the exigencies of business do not allow of the carriers demanding the surrender of these bills of lading in every instance before delivery, they do not any the less belong to the carriers, the contracts for which they were issued having been performed. When, therefore, they come into the carrier's possession by means of claims for shortage or damage and the claims are allowed, what possible right to them have the claimants? The freight or expense bills, being receipts given by the carrier for freight money received, are altogether different; they undoubtedly belong to the person or firm who paid the money to the railroad company, and I have never refused to return them upon demand, first stamping upon them the number of the claim to which each pertained.

Original invoices also most certainly belong to claimants, and certified copies are always received by railroad companies or the originals returned when noted.

If "Merchant" will take the trouble to bring his case before the Claim Department of the "nameless" railroad company, he will find no difficulty in obtaining what he will admit to be justice. CLAIM AGENT.

[We are glad to know that our correspondent, "Merchant," was mistaken, although from the above it is easy to see how the error arose. "Claim Agent" says he returns original papers only on demand. Why only then? If shipper is entitled to these papers they should be returned with the letter declining the claim, and special instructions—if that is the hitch—should be issued by the general claim agent when the order to decline is sent to the subordinate. "A sacred trust" the papers should, of course, be, but why hold at all that which belongs to merchants?

Again, about "clumsy business methods," to which our correspondent refers, we do not quite follow his reasoning. The question of the bill of lading passing title used to be disputed, but now the commercial world is settling down to the theory that the bill of lading passes title to the property only when it expressly states so; that is, when property is consigned "to order." The Trunk Line Association recently adopted resolutions enforcing this distinction. The receipts of the Pennsylvania Railroad read: "Not negotiable unless exchanged for bill of lading to order." If bills of lading are not negotiable, and pass no title, they become mere evidence of receipt and conditions of transportation. As such we do not quite see how the railroad can claim legal right to them, except for identification of consignees? Does "Claim Agent" hold that common receipts are railroad property, too? In a court of law, the delivery of goods can be proved in a number of ways; and a receipt for the claim money given by the proper party to the claim agent, even if accompanied by no other documents, is perfectly valid. In a great many cases bills of lading and freight bills are demanded by the railroads simply to save themselves trouble lest another claim should be made by a second party; but when it comes to that we doubt the legality of any demands for papers belonging to consignee for any such purpose, or even for the sake of stamping the claim number on them. Long-continued custom and, so far, acquiescence on the part of the shipping public should not blind us to the principles involved, nor should we in consequence take public positions which are really untenable.—EDITOR RAILROAD GAZETTE.]

Some Novelties in Interlocking.

The business of designing and manufacturing signaling apparatus for railroads has long been attractive enough to lead many people in this country to undertake it, but notwithstanding our great mileage of railroad that has been very little. The educational process has been slow and expensive, and even to-day among those railroad officers who can control expenditures there are comparatively few who realize the value of proper signals, completely interlocked, and that such signaling is necessarily expensive. The engineers and operating officers who do know these things are numerous, but they have to fight against a great body of ignorance in getting appropriations for such signals as they can recommend. Nevertheless, signaling makes progress, and the signal manufacturers are not discouraged. The latest company to enter the field is the National Switch & Signal Co. at South Eastern, Pa.

This company uses for interlocking the Stevens principle, which has been known for years as simple, durable, easily accessible for repairs or changes, and singularly well adapted to special locking. This last is an important matter. Much ingenuity has been displayed in recent years in minimizing the number of levers and so reducing the first cost of interlocking plants, the cost of maintenance, and the labor of operators. While the demand for these economies is constant, and the stress of competition makes it necessary for

the signal makers to study them carefully, at the same time the demand for complete locking grows also. As knowledge of what interlocking should be extends, both railroad officers and those who design and supply interlocked signals become more exacting of thorough locking. Therefore, to meet these two conditions—economy of material, space and labor, and thoroughness in locking—the art of special or conditional locking has been developed with great ingenuity. As we have said, the Stevens locking lends itself readily to special locking. This principle may be seen applied in a crude way on the machines built by the Long Island Railroad Co., one of which was shown in our issue of Feb. 10, 1888. There it is actuated by the motion of the lever. The same principle simply and elegantly worked out, with preliminary actuation, may be seen in the Johnson machine. The National company has heretofore used the Stevens locking with lever actuation, but is now prepared to build machines with the preliminary movement.

The company controls several special patented appliances of decided merit. One of these is Koyl's parabolic illuminated semaphore. This we illustrated in our issue of Oct. 19, 1888, and since that time it has been described in the *Journal of the Franklin Institute* and other publications and its principle is doubtless well known to our readers. Briefly, this semaphore blade is a longitudinal section of a parabola. A strip of corrugated glass 4 in. wide is placed along the centre line of the blade. In front of the post and in the focus of the parabola is placed the lamp. The upper half of the glass of the lamp is red and the lower half clear. Between these two sections of the glass of the lamp is a small screen. Now when the semaphore is horizontal the red light falls on it, and a beam of red light is seen; when it is lowered to "safety" only the light passing through the clear part of the glass of the lamp strikes it, and a beam of white light is seen. Thus this semaphore gives both a color and a position signal by night. The parabolic form of the blade, of course, concentrates the rays, and they are directed along the track. The slight corrugation of the glass is introduced to disperse the rays sufficiently to cover the field which will be occupied by the cab anywhere within view of the signal. It is quite evident that too great concentration of the rays might make the signal dim in some part of the path of the cab approaching it. We can say from observation that this semaphore is not what the famous and profane Ohio statesman called a "d—d barren ideal," but it is really a very brilliant and striking signal by day or night. It is not only good theory, but it works. There is no question about that; the only objections or doubts that may be brought up are that it is more expensive, heavier and more liable to injury and deterioration in service than the plain semaphore. The greater cost of this signal will probably not usually outweigh its greater efficiency when experience has demonstrated its durability. The inventor is now experimenting to find some reflector to take the place of glass, and if he is successful, as seems very likely, the most obvious objection to this semaphore will at once disappear. Even now we do not say that it is a serious objection. This form has been used very satisfactorily in dwarf semaphores as well as for running signals. Eighty of these semaphores have been erected on the Lehigh Valley and they are now standard on that road.

The National company controls a double-wire compensator recently brought out. It appears to be a very efficient device. It not only compensates for changes of length of the two wires due to changes of temperature, but takes up the stretch of the wires and keeps them always taut. The provision for carrying the signal to danger in case either wire breaks appears to be complete. Orders have been received for 250 of these compensators.

Another specialty of the company is Reif's detector bar which we illustrated in our issue of Nov. 3, 1888. The form shown there was not the best inasmuch as the clip supporting the detector bar and the motion bar extends below the level of the bottom of the rail. As the device is now put in no part of it is below the tops of the ties. This bar is moved by a stroke of 2 1/4 in. and so little power is required that four bars can easily be operated by one lever. This is done at the South Plainfield tower of the Lehigh Valley with entire satisfaction. Many of these bars were put in use on the Main Line Division of the Philadelphia & Reading some time ago and may be seen there in operation. They have been used in all the recent interlocking work of the Lehigh Valley.

The Palmer torpedo machine is also controlled by the National company. This device is probably well known to most of our readers. It has a magazine, holding five torpedoes, and is so connected to the signal connections that when the signal is put to danger a torpedo is put in position to be exploded by a passing wheel. There is no doubt of the success of the apparatus in actual operation on many roads. The Lehigh Valley road is now putting it in place of derailling switches at the Mahoning interlocking. The National company has just received an order for 600 of the machines for Austria.

Mr. Reif has just perfected a simple and ingenious train order signal. Two blades on one pivot are worked by one lever, so that a red signal can be displayed a certain time, and then lowered to display the green signal. Although this is but just completed the company has orders for 15 sets. The company has an excellent selector, by the use of which several signals can be worked by one lever, the signal cleared depending upon the position of a certain switch. The use of this apparatus is no longer novel. It is one of the ingenious devices for saving levers of which we have spoken before. It is doubtless capable of further application than has yet been made of it. On the whole, the new company has a good mechanical basis for a business, and it is actively in the field.

Electrically Welded Rails.

A note which appeared lately in the *Railroad Gazette* on the experiment of the Pennsylvania Railroad with 60-ft. rails prompts Prof. Elias E. Ries to send us a copy of a communication which he has addressed to the *Street Railway Journal*. The communication is a reply to an interview which had already appeared in that journal. We print here such part of it as seems of most interest on the subject of welding rails.

"The objection made during this interview to the method of uniting rail lengths by electric welding, as originally proposed and patented by the writer, seems to have been based upon an error in assuming that in the 'continuous' or electrically welded rails no provision is made for expansion and contraction. As there appears to be considerable uncertainty in the minds of many as to the manner in which this process is carried out, and especially with regard to the provisions made for expansion and contraction, I will endeavor to make this clear.

"The principal features of this system of track construction are familiar to the majority of your readers, an illustrated description of the invention having appeared for the first time in the *Street Railway Journal* for December, 1887, to which reference should be had. Suffice to say here that instead of employing the usual rail joints with their attendant connections, such as fish-plates, bolts, locking devices, etc., the ends of the rails, when in position, are permanently and expeditiously welded together by the passage of a gradually increasing, heating current of electricity through the ends of the rails to be united. In this manner a single, uninterrupted and perfectly smooth rail of any desired length can be made. In order to further increase the strength of the weld, the cross section of the rails is somewhat enlarged at these points during the welding process by the formation of a rib between the head and the flange of the rail, where T or girder rails are employed; or at a corresponding non-obtrusive point or points where flat rails are used. Furthermore, in the case of hardened rails the temper is restored to the welded portions immediately after the welding operation, so as to make it substantially uniform throughout.

"It should now be understood that while these rails are practically 'continuous,' as will become apparent further on, they are by no means theoretically so. In all cases, the length of single rail lengths for any given road is determined by the shape and size of the rail and the amount of expansion and contraction, or 'creep,' that the grade and nature of the roadbed and rail fastenings will permit without undue strain. Here it should be stated that the rail fastenings preferably employed by me are of such form as to permit free longitudinal movement of the rails, while at the same time the latter are most effectively guarded against any lateral displacement. On the New York elevated railroads, for example, the length of each rail on the straight portions of the line could readily be 1,000 ft., and on level stretches considerably more than this. For cable and electric railroads, where rails of the girder type are supported at intervals of 4 or 5 ft. upon conduit castings, and where the street pavement interferes somewhat with the freedom of longitudinal creep, a maximum rail length of about 500 ft. would probably be sufficient, while for flat, centre-bearing rails, supported upon stringers, the length could, on a good roadbed, be considerably increased. Each rail, whatever its length, is rigidly secured at a point midway between its ends, to the roadbed or conduit structure, in such a manner that it can only expand toward or contract from both ends, the centre remaining stationary.

"The coefficient of expansion per unit for steel per degree F. is .000066. A steel rail 500 ft. in length would, therefore, expand or contract .396 in. for each 10 degree variation in temperature. Allowing a maximum range of temperature of 150 degrees F., we have a total expansion and contraction of 5.94 in., or something less than one-half a foot, to provide for in each length of 500 ft. Now, inasmuch as each 500 ft. length is firmly secured at its centre, the maximum movement at its extremities within the entire range of temperature above stated can never exceed three inches. It must, however, be borne in mind that a change in temperature of 25 degrees, which is about the usual maximum variation occurring within the limits of a day of 24 hours in this latitude, can only produce a movement of one-half an inch at the extremities of each 500 ft. rail section, which, of course, is doubled for the thousand-foot lengths. This small amount of daily creep, assisted as it is by the traffic over the road, is scarcely perceptible, and can be allowed without detriment even in cases where the rails are secured by ordinary spikes.

"It will be apparent that some means are required to compensate for the variations in the rail lengths, and to render the rail surface continuous. This is effected in a very simple manner by means of divided 'expansion joints' of special construction. These comprise a rigid elongated chair provided with a self-cleaning groove to receive and guide the ends of two adjoining rail sections, the extremities of the rails being faced off on opposite sides so as to partially overlap each other. The arrangement is such as to provide for the maximum variation that can take place and yet leave the rail surface of the entire line continuous and unbroken, so that the passage of a car from one rail section to the next cannot be detected. On curves the rails forming the curve are welded together, and form a section by themselves, the fixed portion being at the centre of the curve, and the expansion joints being located on the straight portion of the track a short distance before and beyond the curve respectively. Full provision is also made for removing worn or defective

portions of any rail section and replacing the same with a new rail of corresponding length whenever necessary, and this can be readily accomplished without interruption to traffic by means of a special electrical appliance devised for the purpose.

"The rail-welding process is applicable to old and new roads, and the time occupied in forming the weld joints is comparatively short. The current required for the purpose of effecting the welds may either be supplied by a local apparatus or taken from any suitable electric light circuit, the wires of which extend along the line of way, the current in the latter case being 'transformed' into a heating current at or near the welding clamps. The cost of construction on new lines is much less than the cost of the fish-plates, bolts, nuts, washers, etc., that are dispensed with by it, and the strength of the welded joints is many times greater than that of the joints now in use. When applied to new conduit lines, whether electric or cable, the brackets or yokes are preferably formed with a grooved support, permitting free longitudinal movement of the track rails. In the case of electric railroads, the conduit or overhead electric conductors are likewise welded electrically by the same process. The various details connected with this system, and others not here referred to, have been fully considered and form the subject of several patents and pending applications for letters patent, both in this and other countries."

Baldwin Locomotive No. 10,000.

We take great pleasure in placing before our readers some excellent cuts of the ten-thousandth locomotive built by the Baldwin Locomotive Works. Very appropriately this engine is one of the heaviest consolidations. It belongs to the class weighing 75 tons without the tender, with a weight of 135,000 lbs. on the drivers. It is designated as class 10-38-E 32.

The illustrations show very clearly the principal details of the locomotive. The following are the general dimensions:

Gauge	4 ft. 8 1/2 in.
Actual weight in working order, exclusive of tender	135,000 lbs.
Actual weight on driving wheels	135,000 lbs.
Estimated weight of tender, including coal and water	75,000 lbs.
Estimated weight of locomotive and tender, in working order	225,000 lbs.
Cylinders	22 x 28 in.
Ports—Length	16 in.
Steam port width	1 1/2 in.
Exhaust port	3 1/2 in.
Bridge	13 1/2 in.
Centre to centre of cylinders	49 in.
Valves	4 1/2 in.
Diameter of piston rods	4 in.
Throttle—Poppet balance diameter	7 1/2 in.
Dry pipe diameter	7 1/2 in.
Steam pipe diameter, each	6 in.
Lap of valves	6 in.
Valve travel	5 1/2 in.
Lead	1 1/2 in.
Eccentric travel	3 in.
Diameter	16 in.
Length of crosshead	20 in.
Driving wheels, four pairs coupled, diam.	30 in.
Engine truck wheels diameter	31 in.
Main pin diameter	6 in.
Length	5 1/2 in.
Tire flange width	5 1/2 in.
Thickness	3 in.
Tire, plain, width	8 1/2 in.
Thickness	3 in.
Driving wheel seats, diameter	8 1/2 in.
Length	9 in.
Driving journals, diameter	8 1/2 in.
Length	9 in.
Driving axle, diameter in middle	4 1/2 in.
Engine truck wheel seat, diameter	7 in.
Journal, diameter	9 in.
Length	4 1/2 in.
axle, diameter in middle	4 1/2 in.
Total wheel base	22 ft. 3 in.
Drive wheel base	19 ft. 1 in.
Total wheel base of engine and tender	49 ft.
From centre of truck to first drivers	59 in.
From centre of truck to second drivers	58 in.
From centre of truck to third drivers	62 in.
From centre of truck to fourth drivers	58 in.
Centre to centre frames	4 1/2 in.
Boiler of steel, 1/2 in. thick	72 in. diam.
Length of barrel	19 ft. 7 in.
Diameter of barrel	24 in.
Thickness of tube plate	1/2 in.
Rivets, diameter	1 in.
pitch	3 1/2 in.
style	Butt.
Height of centre line of boiler above rails	7 ft. 8 in.
Fire-box, length	10 ft. 1 in.
width inside	48 in.
depth	63 1/2 x 69 1/2 in.
material crown thickness	3/4 in.
sides and back	1/2 in.
tube	3/4 in.
stay bolts, diameter	3/4 in.
pitch	16 in.
Tubes, 27 in number, 2 1/2 in. diameter	13 ft. 6 in. long
Thickness	No. 12 B. W. G.
Smoke stack diameter	18 in.
Height from rail to top	11 ft. 6 in.
Heating surface of fire box	172 sq. ft.
Heating surface of tubes	2,121 sq. ft.
Total heating surface	2,293 sq. ft.
Tank capacity	3,600 gal.
Driver brake	Eames equalized.

This engine is one of several of the same class built for the Northern Pacific, where they have been very successfully used on the heavy grades and sharp curves of the mountain sections. A recent report of the performance of one of them states that it has hauled 20 loaded cars, weighing about 600 tons, on grades of 1 1/2 ft. and curves of 10 degrees. The total load, including engine and tender, was probably 7 1/2 tons.

On such heavy grades, the resistance due to unknown factors is a small percentage of the total resistance. In this particular case the resistance due to the grade alone is much larger than all the other resistances, therefore the estimates based upon the conditions are of interest and perhaps of value. The grade is 1 1/2 ft. per mile, or about 2 1/2 per cent. This alone would cause a train resistance of 30,400 lbs. A fair estimate of the frictional resistance is 6 lbs. per ton of total load. This increases the resistance by 4,800 lbs. It will be seen how small is