RAILROAD GAZETTE

FRIDAY, JUNE 8.

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# Contributions.

## Ventilation.

JUNE 3, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I am pleased to see from your editorial of last week that there is one at least amongst the number of railroad commissioners who asks why the matter of ventilation is not entailed on that of car heating. It is a crying disgrace to the intelligence of car builders that they have not, and will not do anything that is sensible towards the relief of the suffering thousands pent up in close, heated cars throughout the land. At one time I was led to think that a more stubborn, bull-headed class of men did not exist than railroad mechanics, and on my first introduction as sanitary engineer to a New England railroad official of long standing, when happening to question the present methods of car ventilation, he very emphatically told me "if I was not by introduction a friend of his, he would show me to the door with a shotgun." He then proceeded to explain how much men in his position were pestered by "cranks" on this and like matters. This led to a degree of sympathy with railroad officials which has not been lessened by closer associations with them and knowledge of the difficulties they have to encounter in dealing with owners of new devices. The flood of wretched contrivances offered has brought it about that you might as well shake a red rag at a bull as say the word ventilation to a car builder.

We should very naturally kick with emphasis if any one required us to wash in the filthy water used already by another, but we contentedly breathe over and over again the air which has passed through lungs and over bodies foul and diseased, within and without. Thus we strain at a gnat and swallow a camel. I ask the public, you the editor, and you the constructors of cars, to consider this matter in the sanitary sense, and to simply arrange for rendering innoxious the poisoned atmosphere of our cars.

I know it to be a hard job to educate the public and a good many railroad officers to stand fresh air if they know they are getting it. You will have to smuggle it into the cars. Witness the expression of astonishment that overspread the genial face of Mr. Adams, of the Boston & Albany, at a late New England Railroad Club meeting, on learning that one of the greatest roads in the country had tried Pennycuick's system of ventilation in a very crude form by cutting fresh air openings in the floor under each seat. He called for a repetition of the remark, and being satisfied that he had heard aright, he asked, "Did you not kill the passengers or blow them all out of the car?" Although these 3 in. by 4 in. openings were only screened by wire gauze the car was peculiarly comfortable.

I attach a cutting from your own editorial of Oct. 28, 1887, for the benefit of the commissioner and as stating the principle:

> If air is distributed and directed so as to strike on the steam pipe in small jets and become warmed before being admitted into the car, no disagreeable effect or cold draft will be felt, and the benefit of fresh air at a comfortable temperature will be obtained. Unfortunately, few inventors seem to recognize that heating and ventilation should go hand in hand, but it is to be hoped the present opportunity for a material improvement in the ventilation of railroad cars will be properly utilized and such a serious source of discomfort, ill health and death as foul air will be swept away by the current of fresh air which the improved system of heating renders possible.
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> Many systems of ventilation depend wholly or in great part upon the movement of the train, and are thus defective in principle and unequal in action, giving a strong draft when the wind is blowing hard or the train running fast, and becoming inoperative and permitting stagnation when the car is standing still. Any constant supply of heat will, however, produce a constant upward current of air, and as the heat from steam pipes can be tolerably equally distributed throughout a car, it follows that steam heating renders possible a constant and equal circulation of air throughout the car, and that it is practically possible to make the ventilation independent of the speed of the train and tolerably equal in all parts of the car.

SANITAS.

## Locomotive Side Rods.

ST. LOUIS, May 28, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of the 25th inst., Mr. John C. Trautwine, Jr., in commenting on a previous communication of mine on "Locomotive Side Rods," asks if the *f* in my formula is not really the *modulus of rupture* instead of the *fibre strain*."

In replying to this query I would say that I consider these two expressions as synonomous *within the elastic limit.* The values given, 12,500 and 16,300 lbs. per sq. in., are far within the elastic limit of either iron or steel, and that therefore, in this case, the *f* used in the formula is both the modulus of rupture and the strain on the extreme fibres of the bar.

This raises at once the old question whether or not the ordinary formulæ for cross-bending are to be considered as really giving the facts of the accompanying phenomena, or are they to be considered as simply convenient expressions, based on untenable hypotheses. The latter view is quite generally held, but I think it is erroneous. The error comes from finding the formulæ to fail on *breaking tests.* Now there is nothing in the hypothesis that would lead one to *expect* the formula to hold *beyond the elastic limit.* It all depends on this: *Does a plane cross-section remain a plane after the beam is bent?* So far as experiments go, I think they all show that a section plane before bending remains a plane after bending *until the elastic limit stress is reached in the extreme fibres.* Then the plane becomes a curve, and the law of a uniformly varying stress no longer holds. Until some experimenter shall show that this is not the case, it is not wise to assert that the ordinary formulæ for cross-bending are not rigidly correct within the elastic limits.

Furthermore, it is evidently bad designing to allow a known fibre strain of 16,000 lbs. to recur in an important part of a locomotive, and to repeat itself indefinitely in opposite directions, when a breakage would be so disastrous, and the danger could be avoided so easily as it can be in the case of a locomotive side rod. The rod described in my communication of Sept. 16, 1887, was one which I happened to find in the round-house of the Missouri Pacific, in this city, where I went expressly to measure a few for purposes of illustrating the subject. It was on a passenger locomotive of that road, and evidently was designed for passenger service. If it was not designed to run at as high a speed as 70 miles an hour, then it *should* have been so designed, for I think any passenger engine is liable to attain that speed at the foot of a grade on every trip it makes. If not at the foot of a grade then when it spins its wheels, which is just as bad for the side bar, but not so dangerous to the passengers perhaps. I have no reason to think the Baldwin locomotive company is alone in making dangerous side rods; but whether it is or not, no love for a "home establishment" should cause one to "rejoice to swear by it" when it is shown to be in error.

J. B. JOHNSON.

## Interlocked Switches and Signals.

BY CHARLES R. JOHNSON, C. E.

III.

In giving a general sketch of interlocking as it stands in this country, it will not be out of place to enumerate some of the more prominent devices that are used to accomplish the end and aim of interlocking signaling, which is to actuate switches and signals in a perfectly safe way in the most rapid and economical manner. A great many people fail to realize that the subject must be treated as a whole to attain good results, and not in parts. Many inventors have labored industriously to perfect an interlocking machine, or a signal, or a compensator, or a particular kind of blade, thinking that when that was accomplished, they would hold the key to signaling. In signaling, too, as in other matters, people go to work inventing before ascertaining what has already been accomplished.

The interlocking machine naturally comes first in order, because it is the basis on which all other parts depend. In speaking of machines in this connection it will be understood that *lever* machines are referred to and not *capstan wheel* machines, which are quite new and not thoroughly perfected. It will be a surprise to a great many railroad men to learn how many different kinds of machines have been manufactured and used. The most prominent are the Stevens & Sons, the Saxby & Farmer, the Webb (confined to the London & Northwestern Railway of England), the Imray (used only on the Midland Railway of England), the McKenzie, Clunes & Holland, and the Ransome & Rapier. Machines have also been invented and manufactured by Messrs I'Anson, Kitchen, Easterbrook, Buck, Baines, Baker, Hannaford, Cochrane and Smith, but scarcely any are now in use. The Johnson was invented in 1885 and is not yet very extensively known or used, but is standard on the Manhattan and the New York, New Haven & Hartford, and used on several other roads.

The Stevens machine was the first in the field, and for simplicity and durability the locking has never been equaled, and in the latest machine (the Johnson), this principle of locking is retained, but applied differently. A sufficiently clear description of this machine is given on page 84 of the current volume of the *Railroad Gazette*, as used on the Long Island Railroad. The Stevens machine has been extensively used on all the large railroads of England and Scotland. The objections to the machine are that the locking is not preliminary, and is not easily accessible for alterations or additions.

The Saxby & Farmer machine is probably the most used and most widely known, having been fixed in large numbers in almost all quarters of the globe. The writer has erected this machine in Great Britain, Ireland, France, India and America. A description and illustrations of this machine will be found in the *Railroad Gazette* for 1878. The objections to it are that the parts wear considerably, and it is difficult to apply complex locking, and a portion of it (the lower bars) is always difficult of access.

THE WEBB MACHINE.

The Webb machine, designed for and used only on the London & Northwestern of England, has "lever locking" as distinguished from "catch rod locking." The locking machine is of the horizontal and vertical bar type, but much more carefully constructed than usual. The horizontal bars are of Bessemer steel, rolled to a shallow channel; the locking studs are squared to fit the channel and are then secured. The vertical notched bars are also of steel, the notches being punched out cold. Each vertical bar is guided by a channel the length of itself, and one wall of this channel is made deeper than the other and notches are cast in it to act as guide for the horizontal bars, the notches being faced by a special drifting machine at the rate of thirty-five notches per hour. The motion of the lever is communicated to the vertical notched bars by a double, hook-shaped lever, centered on the lever which hooks over a projection cast on the lever quadrant casting. Upon the lever being moved $\frac{1}{32}$ inch, the book lever is tilted up, communicating sufficient motion to the locking bars to effect all necessary locking, and it is further tilted when the lever is within $\frac{1}{32}$ inch of its pulled over position, communicating additional motion to the locking bar to effect the necessary unlocking.

Owing to the position of the centre upon which the hook lever turns, any strain put on a rock lever is taken principally by the main framing, and the locking, which is of a light design, is thus saved from undue strain. If the apparatus be large and the locking bars numerous, the vertical notched bars are divided in the middle by a short compensating lever, and being thus counterweighted, any length of bar can be used. A machine in course of construction for Rugby has bars 18 ft. deep. A detail highly appreciated by the operators working the machines is the loop handle (used also on the Johnson machine), which Mr. Webb has substituted for the spring catch handle usually provided.

Of the 26,500 levers on the London & Northwestern, about one half are of Mr. Webb's pattern. Their working has been everything that can be desired, and although many of the machines are at busy junctions, notably Crewe with 144 levers, and Spring Branch with 80 levers, in which latter tower 9,065 levers are pulled over and put back in twenty-four hours, the cost of maintenance has been trifling. The largest machine of Mr. Webb's pattern is that provided at Crewe, where six lines of railroad meet at a common junction north of the platforms. Previous to the erection of this machine the junction was controlled from two towers, and some doubt was raised as to the wisdom of concentrating so much work in one tower. A single tower containing 144 levers, was, however, provided, with the result that the junction has been worked more economically and with increased safety; misunderstandings likely to arise out of a joint control being avoided.

A machine in the course of construction for working the south junction at Rugby will contain 180 levers, 84 horizontal locking bars, each 83 ft. long, and 180 vertical bars, each 18 feet deep. The tower will be 96 ft. 6 in. long by 12 ft. wide and 23 ft. high.

The above description of Mr. Webb's machine is taken from the paper read by Mr. A. M. Thompson, Assoc. M. Institute C. E., London, before the Institute, on May 5, 1885.

## Pneumatic Interlocking.

Compressed air has been applied to the movement of switches from interlocking apparatus in some ten or a dozen different plants, erected by the Union Switch & Signal Co. There are several towers in use at or near Oakland, Cal., and at least three in the vicinity of Pittsburgh, and still another is now erecting.

A cylinder is placed near each switch, and the movement of a piston in that cylinder is communicated by a rack and pinion gearing to the switch rails. If a facing-point lock is used, the connection is so arranged that in the first part of the piston stroke the bolt is withdrawn, in the middle of the stroke the rails are moved, and at the end of the stroke the bolt is shot again. It will be readily seen that this can be easily done with sufficient stroke and power. An air reservoir is placed near, and the admission of air from the reservoir, to one end or the other of the cylinder, is governed by a valve which is controlled by the operator in the tower. The connection from the tower to this valve is by small pipes filled with a non-freezing liquid. Compressed air, admitted to the top of the column of liquid in the tower, gives an impulse, which is transmitted at once to the valve, and causes air to be admitted to the switch cylinder.

The signals are actuated also by compressed air, by the method now used on the Fitchburg, and formerly used on the West Shore, for block signals. The same apparatus is used to move the block signals on the Pennsylvania for some nine miles out of Pittsburgh. Briefly, air is admitted from an auxiliary reservoir to a cylinder on the signal post by the movement of a valve which is electrically controlled. In the interlocked signals this valve is controlled from the tower machine; in block signaling it is controlled by a track circuit. The air is compressed for the yard tower in Pittsburgh by a small compressor near by. For the Wilkinsburg and East Liberty towers, 4½ and 7 miles out, and for the block signals in that vicinity, the compressor is at the Torrens' shops, five miles from Pittsburgh. It is intended to have the compressing for the whole Pittsburgh system done at Torrens. The working pressure for the switches and tower apparatus is about 60 lbs. per square inch.

The interlocking apparatus, through which motion is given both to switches and to signals, cannot be satisfactorily described without illustrations. It is enough to say here that it takes up far less space than mechanical interlocking, and that the labor of working it is very light. The interlocking can be made as effective as by any other apparatus, but the multiplication of parts has been objected to as making it more liable to derangement. The ground connections can be buried out of the way, and can be led out from the tower in any way most convenient, and these must often be great and obvious advantages.

At the same time the relative economy of this system and of those which move the switches and signals by pipe and wire connections must depend on the special conditions of the place to be worked. In a large yard where many levers and much ground connection would be required, or in a situation where several towers can be supplied from one compressor, the pneumatic system might often be economical, and it can readily be imagined that the economy in operation might be very considerable. On the other hand, it would obviously not pay to put in a boiler and compressor for a small, isolated plant. The line at which one or the other system begins to be the more economical must be determined in each special case.

### Shops of the Pond Machine Tool Co.

Messrs. Manning, Maxwell & Moore have sent us a blue print of the shops of the Pond Machine Tool Co. at Plainfield, N. J., on the line of the Central of New Jersey. The same drawing is reproduced in the current number of the *American Machinist*, and from the description given in that journal we make a few extracts.

The machine shop is 500 ft. long and 100 ft. wide, one story high, and abundantly lighted and ventilated from the roof, as well as by windows in the side walls, and heated by overhead system of steam pipes. Through the centre of the building runs a track connecting with the railroad, and while there the writer saw a locomotive come in and deliver a car load of stock beside the machine where it was wanted.

The space between this track and one of the rows of posts which support the roof and traveling cranes constitute the erecting floor. and is provided with a pit 100 ft. long, 10 ft. wide and 6½ ft. deep, walled up with brick, and having a cement floor. On the other side of the track, and between it and the other row of posts, the heaviest machine tools are placed.

Above the track, and the spaces each side of it, are two large traveling cranes. each of 15 tons capacity, made by the Morgan Engineering Co. Either of them can travel the entire length of the building, and they are both driven from a 3-in. square shaft, which is in one piece 500 ft. long, weighing 7½ tons. It is turned round at the bearings, which touch the shaft on the under side only, and are automatically swung out of the way to allow the cranes to pass, and restored to their places afterwards. The two cranes command a floor space of 500 × 42 ft., within which all the heavy work is done. Outside of the two rows of posts, and between them and the outer walls, are the smaller machine tools, these spaces being provided with small traveling cranes worked by hand, that over the planers being simply a single rail, upon which travels a hand hoist.

Adjoining the machine shop is the engine room, in which is a Brown engine of 200 horse-power, and a dynamo for electric lighting (incandescent system), run by a double Armington & Sims engine of 100 horse-power. Under the engine room is a cellar in which are the steam pumps, one for returning the condensed steam from the heating pipes to the boilers, and the other for fire supply and general service. Electric signals are all over the building, communicating with the engine room, and when by this means the engineer receives the fire signal, he goes to this pump, puts an additional weight on the automatic valve which controls it, and the pressure is immediately increased to 100 lbs. At that pressure six streams can be thrown on to a fire in any part of the buildings.

In the south end of the machine shop, in the corner next the foundry, is the stock room, where all supplies are received. The railroad track runs by it, and at right angles to this track another one runs through the stock-room, and on through into the cleaning room of the foundry; the two tracks being connected by a turn-table in front of the stock-room. Inside the stock-room are track scales on which all castings coming from the foundry are weighed and checked off without being unloaded from the small car on which they are conveyed.

The cleaning room is in the north end of the foundry building, separated from the foundry by a low partition, which allows the large traveling crane to pass over it. This crane is similar to those in the machine shop, and travels the entire length of the foundry.

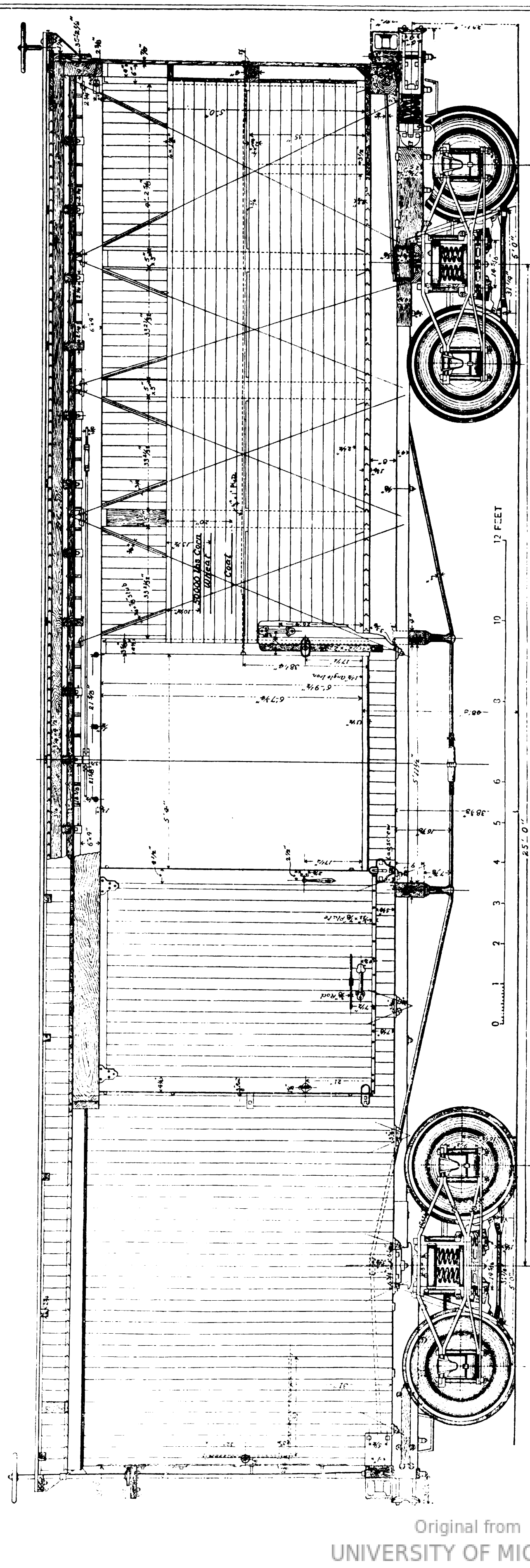
In the foundry is a core oven of improved construction. The bottom of the oven is level with the floor of the foundry, and a track runs into it, on which is a truck made entirely of iron. Large cores can be placed on this truck and run into the oven and baked without handling, after which they can be drawn out to a swinging crane, which stands near the oven, by which they can be delivered to the large traveling crane. The core oven is fired at the end opposite the doors, and the heat from the furnace passes through cast-iron flues of flat section, which pass back and forth through the oven at the sides. It is very efficient, a surprisingly small fire serving to keep it amply heated.

There are two cupolas capable of melting 8 and 15 tons of iron per hour respectively, blast being furnished by a large Root blower. Back of the cupolas is a large clear space, providing for free access, and in this space is a hydraulic lift, on the platform of which are rails which are a continuation of a track which runs out into the yard where the iron is kept.

The charging floor, 14 ft. above the molding floor, is 48 ft. square and composed entirely of iron plates. Iron is delivered by this floor in two ways. Pig iron is delivered by the railroad to the yard, from whence it is taken on a small car to the hydraulic lift before mentioned, and raised to the charging floor, where it is unloaded near the charging door. But if it comes in such shape as to be ready for the cupola, the cars in which it comes are pushed by a locomotive up the inclined track to a point over the sand storage vaults, and on a level with the charging floor, where it is unloaded ready for use. The fuel for the cupolas is also delivered at the same level to bins provided for the purpose.

Cars containing coal for steam making are pushed on over a trestle-work to a point over the boiler-house, and dumped through the roof in the same manner. Track scales at the foot of the trestle-work afford facilities for weighing all stock before it is unloaded.

The blacksmith shop is entirely detached from the other buildings—the blast for the forges and the steam for the steam hammer being taken to it by pipes. It is 52 × 32 ft., and the walls, with the exception of door openings, are solid to a point about 6 ft. from the ground, above which they are almost entirely of glass, which is in frames so mounted that they can be swung out at the bottom, and in at the top, upon a pivot fixed at the centre. Iron forges are used, and a branch from the blast pipes is taken up into the flue above each forge and turned upward. The blast in the pipe can be regulated, or turned on or off at pleasure, and helps very



STANDARD 50,000-LB. FREIGHT CAR, LEHIGH VALLEY RAILROAD.