RAILROAD GAZETTE

FRIDAY, DECEMBER 21.

CONTENTS.

Contributions.

Car Lighting.

NEW YORK, Dec. 17, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Dec. 14 I notice a very intelligent article on Car Lighting, which may, with advantage, be supplemented in one or two points, as the subject is one of great interest to railroad managers. You say: "If cars are to be satisfactorily lighted by gas, they must have lamps which will give at once a very steady flame and a high degree of illumination in proportion to the amount of gas burned." These desiderata are so perfectly attained in the practical car lamps for burning Pintsch gas that I am surprised they are overlooked in so full a presentation of the subject as you have given. The new lamp of the Pintsch equipment is a four-flame lamp, each flame consuming five-eighths of a foot per hour. These four flames, burning altogether 2½ cu. ft. of gas per hour, are found to have by photometric tests an illuminating power equal to 35 candles, measured without reflection. This lamp casts no shadow, does not in any way vitiate the air of the car, but on the contrary acts as a constant ventilator, carrying the impure air from the car, never flickers under any conditions, and is not disturbed by the most violent agitation of the air. The opening and closing of doors, windows or ventilators, in no way affects the lamp. No other form of regenerative lamp has ever been devised which has these qualities. A Pintsch gas light and other regenerative lights, tested side by side in the slight current generated by the waving of a fan, or even a sheet of paper in the hand, shows very remarkable differences. So far as the conditions you mentioned are concerned the Pintsch lamp leaves absolutely nothing to be desired, and I do not think I exceed the limits of strict truth in saying that it is the only practical gas lamp ever devised for cars.

In the concluding paragraph of the article I find the following: "One great bar to lighting cars by gas has always been the difficulty of carrying enough gas in cylinders under the car to supply them with a good light for a long journey. The cars had to be kept within daily reach of the gas works, thus forcing the roads either to light only special trains or multiply gas works." I do not think it will be claimed upon examination that the bar to the gas lighting of cars upon which you lay so much stress applies in any degree to Pintsch gas. A cylinder of 20 in. diameter and 8 ft. long will hold gas enough to run a car from New York to Chicago and back, with brilliant illumination, during all the time when light is required, and without the necessity for the least economy in burning it. It will then be found that gas enough remains to carry the car for a long distance on its western journey, but presumably the cylinder would be filled again at the terminal points, which would involve but one-eighth the cost of labor necessary to replenish the oil in its lamps. A private car, lighted with Pintsch gas, was out on the road nearly a month and had gas enough to light it home without replenishing its cylinder. It is a fair presumption that the gas was economized on this extraordinary trip, but not to the extent of depriving the tourists of sufficient illumination for comfort and pleasure. It cannot be said with truth that gas lighted cars need to be kept within daily reach of the gas works. Sources of supply 48 or 60 hours apart are quite near enough for practical purposes, and if the convenience of railroad management demands reservoirs of gas at intermediate points these can be provided in this country as they are on most of the roads of Europe, by means of tank cars into which the gas is pumped at the works, under high compression, to charge the small cylinders when necessary. It is no more trouble to transport gas 100 or even 1,000 miles in such a tank, than it is to transport petroleum in a tank car, and with no possible danger. It is the intention of the company controlling the Pintsch patents for this country to build gas works at all the principal railroad centres of the country, and in view of what experience has shown to be the practicability of long distance lighting without recharging the cylinders, a dozen gas works would supply illumination for all the railroad cars running in the United States on roads of consequence.

It is a cause for surprise that the Pintsch lighting system is not better understood and appreciated in this country. In Europe it is almost universal. It has been extensively introduced in Germany, Austria, France, Russia, Italy, Holland, Belgium, Egypt and Great Britain, and now lights nearly, if not quite, 28,000 cars running on foreign railroads. In this country it is employed in illuminating the cars of the New York, Lake Erie & Western, the West Shore, the New York, Providence & Boston, the Chicago & Atlantic, the boats of the Providence & Stonington Steamship Co., and three of the lines of ferryboats crossing the Hudson River. In every instance it has been found superior to any other form of car illumination, and as much cheaper as it is better.

J. C. BAYLES.

The Westinghouse System of Pneumatic Interlocking.

Before entering into a description of the operation of this system, it will be necessary to describe the construction and operation of its several parts. There are a steam generating boiler, an air compressor, and a condensing tank through which the air must pass before entering the main air pipe. This deprives the air of any moisture which it may have had originally, or collected in passing through the heated cylinder of the compressor, and prevents its collecting in the valves or cylinders where it might interfere with their operation.

Each signal blade is connected directly to a pneumatic cylinder, the pressure to which is controlled by a small valve actuated by an electro-magnet which in turn is controlled by the operator in the cabin. The air supply to each of these cylinders is taken from a cylindrical tank at the bottom of the post, all of which are connected directly to the main air pipe; consequently, all signals have, at all times, the full pressure of the compressed air, right at their cylinder valves. The control of this pressure by the electric valve and the valves by the operator will be treated later.

From this same air pipe pressure is conducted to the switch valves, where it is stored in a reservoir, which forms the valve support, and is provided with a cap or plug with three ports formed in it, and a D-valve seated over them, exactly as is done in a steam engine. Encasing this D-valve and its ports, see fig. 4, *A*, is a hollow cap fastened to the reservoir and connected with it so that the full pressure from the reservoir is at all times in it, and consequently on top of the D-valve, holding it seated. One of these ports connects directly to the open air; this is the centre one, while the right and left ones connect each to one end of the cylinder operating the switch. This D-valve is so constructed that it is impossible to admit pressure to one of the ports before having connected the other with the exhaust. It is, therefore, very evident that it is impossible to have pressure on both sides at one time, and also that the full air pressure is always holding the switch in the position last moved to. With this description, it will be clear how the pressure can be changed to one end or the other of the switch cylinder.

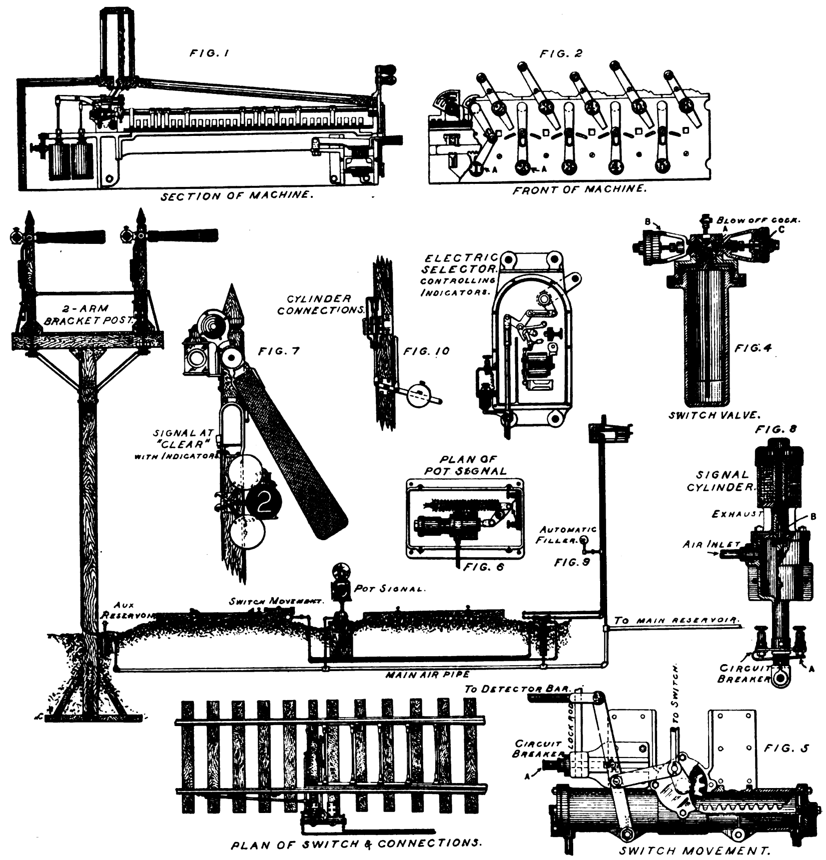
The switch movement, fig. 5, consists of a long cylinder, 5¼ in. diameter, provided with two flanges for securing it to the ties, and two studs or trunnions on the opposite side forming pivots for an arm operating the lock and detector bar of the switch, a piston composed of a plunger packed at each end and formed into a rack between, engaging into a pinion which rotates about ¾ of a revolution to each movement of the rack piston. This pinion is keyed fast to a shaft on which a crank is formed, and turns with the pinion. To this crank the operating rod of the switch is connected, and also a link joining it to the rod already mentioned, operating the lock and detector bar. It will be noticed that this crank stands beyond the centre line of its axis continued through the centre of the switch connection, and that it might move a corresponding distance to the right of this centre line before giving any appreciable motion to the switch itself, on account of the small arc thus described. It is the peculiar arrangement of this crank that renders this movement so simple in effecting the motion of the detector bar and the preliminary unlocking of the switch and a final motion of the bar and locking of the switch after it has been moved. By reference to the cut it will be clearly seen that the movement, when normal, holds the switch locked in one of its two positions and the detector bar below rail level. Also that the first motion to take place is the simultaneous raising of the bar and unlocking of the switch. The lock bolt thus operated is of sufficient length to have been fully withdrawn from the hole in the lock rod of the switch before the motion of the crank is imparted to the rod moving the switch. It is also, for simplicity sake, allowed to travel still farther from the lock rod during half the motion of the switch, when it again approaches the rod, and by the time it arrives at the bar again the switch must have moved so as to bring the second hole in the lock rod opposite the pin before it will become locked, and indicate it in the cabin in a way to be yet described. On the casting forming a guide for the lock rod, directly in front of the locking pin, is placed a circuit-controlling device (fig. 5 *A*), which, when the lock pin has entered the lock rod of the switch, holds the circuit open, and when the pin is withdrawn permits it to become closed. The function of this device will be described later.

Having described the construction of the switch valve, we will explain the manner of operating it. On each side of the hollow chamber or cap encasing the D-valve, fig. 4, *B*, are two small cylinders containing pistons, and a stem from each extending through a stuffing-box into this cap or chamber and resting one against each end of the D-valve. Connected to the heads of these two cylinders are two small pipes which run directly into the cabin to the machine, where they run to the ports of a three-way cock operated by the switch lever, fig. 8, *A*. This cock is identical in operation with the D-valve, in that but one port can have pressure on it at a time, the only difference in its construction being that its seat is cylindrical, or rather, conical, instead of flat on a horizontal plane, as is the D-valve. It is evident that pressure must be on one or the other of these small cylinders, fig. 4, *B*, at all times. It is also evident that since the D-valve is set between these pistons, any motion of them will be imparted to the valve also, and that the pressure on each piston acts against the other one through the valve, thus making the two pistons and the D-valve act as a solid plunger in a single cylinder. The D-valve is not in any way connected with the piston stems but simply guided between them, thus allowing compensation for wear on the seat and under face of valve. It is often desirable to throw two or more switches by the same lever as is the case with crossover or slip switch with movable frogs. In such cases, unless they be too far apart, but one valve is used, and each one of the two or three switch cylinders is connected directly to it in the same manner as is that of a single one. It is perhaps necessary to explain now the necessity of this valve being interposed between the cock at the machine and the switch cylinder, since it will be evident that the operation would be the same if the pipes from the machine went directly to the switch cylinder. While this is the case, still a serious feature in this arrangement prevents its adoption. Owing to the extremely long distance it is oftentimes found convenient to operate switches from the cabin with this system, and the consequent long line of pipe necessary to be filled with air and exhausted at every movement of the switch, it is found not only more economical in saving air, but very much more efficient in operation to place this valve as close to the switch or switches operated as possible, and fill the small pipes leading from the small cylinders of the valve to the machine with water in summer, and chloride of calcium, alcohol or some other non-freezing liquid in winter. When this is done and the air from the machine cock is admitted on top of it, it instantly acts against the pistons of the small cylinders of the switch valve, fig. 4, *C*, since the liquid will not compress, but acts as a solid rod. This would not be the case were the air used alone, since it would require some time to compress to the pressure necessary to move the valve, and waste a corresponding amount by connecting the opposite side to the exhaust. In order to compensate for loss of liquid by evaporation or leak, an automatic filler is attached to all hydraulic pipes, fig. 9, which, normally, is opened with all of them not having pressure on them, and automatically closed from them, by means of a check valve, when the pressure is admitted on top of the water in them. This insures a full supply of liquid in these pipes at all time and consequently a quick action of the switch valve.

The cylinder operating the signal will now be described As before stated, this cylinder, fig. 8, has the pressure right at the valve controlling its admission to it. This is also controlled by an electro-magnet, the circuit of which is controlled by the operator through the machine. The piston of this cylinder is connected with the blade either directly or through a balance lever, fig. 10, and in its normal condition is in the upper end of the cylinder being held there by the counter-weight blade or balance lever. In this position of the piston the blade is in the horizontal or danger position, and can only be moved from that position by the admission of air on top of the piston, thus depressing it sufficient to give the blade the proper angle (60°) indicating safety or caution, according to the nature of the signal. This is accomplished by a small pin valve, fig. 8, *B*, which normally holds the pressure closed from the cylinder, and the cylinder open to the exhaust. When operated by the electro-magnet becoming charged from a current sent through it by the operator, the reverse condition takes place, *i. e.*, the pressure is admitted to the cylinder on top of the piston, and the exhaust is closed completely. The pressure thus confined depresses the piston and operates the blade. The instant the current is broken on the magnet the armature is released and the air again unseats the valve, closing the exhaust, and again cuts off the pressure, thus allowing the counter-weight signal to return to danger. This cylinder is also provided with a circuit breaker controlling the current to an electric lock to the lever operating it, fig. 8, *A*. The construction of this lock will be described with the machine, later. This current is closed only when the signal is in its danger position, and open at all other times, and since the lock releases the lever only when the current is on it, it is evident that the lever is unlocked only when the signal is in the danger position. Consequently when the signal is cleared the lever operating it is automatically locked, and should the signal fail to go to danger after the circuit has been broken by the lever controlling it, that lever will remain locked electrically, and hold all switches locked mechanically over which that signal gives right of way, until it does return to danger.

The small pot, or drilling signal, fig. 6, consists simply of one of the same cylinders as are used to operate the semaphore signals, placed horizontally in a cast iron box or case and connected to an arm keyed fast to a vertical shaft to which the signal target and lamp are secured. When operated, the cylinder turns this shaft one-quarter of a revolution, thus changing the target or light. The opposite side of this arm is extended, and connected to a long spiral spring, which returns the signal to danger when the cylinder is discharged.

When it is desired to operate indicators in connection with the signal, a device is provided in a well covered box, fig. 11, fastened directly under the signal blade and operated by it. This aparatus is provided with a pair of electro-magnets for each indicator rod, and a simple means of throwing one or the other of these rods into engagement with the signal, by them, so that it will be operated rigidly thereby. The



THE WESTINGHOUSE SYSTEM OF PNEUMATIC INTERLOCKING.

number or letter, fig. 7, displayed when the signal is cleared indicates to what track the switches are set. This system of signaling is of advantage in yards where a great deal of drilling is done, on account of its simplicity in construction and operation, the small number of lamps employed and the ease with which they can be read. When the signal is at danger the indicators are obscured by a screen which lies in front of them.

It is necessary here to explain that all levers controlling signals (fig. 2, *A*) when thrown out of their normal (vertical) position, *i. e.*, to the right or left, effect the locking of switches during the first part of their stroke, and close the circuit on the signal at the end of the stroke. After the electric locking takes place, when a signal has been cleared by the signal lever being thrown completely to the right or left, it is possible to throw the lever sufficiently far normal again to break the circuit to the signal, but not far enough to release the locking to the switches; in this way the signal must go to danger before the switch levers can be released. The great advantage of this lies in the fact that should a signal stick at safety it indirectly locks all switches which require shifting in order to set a signal for a route conflicting with it. It is therefore impossible to give two conflicting signals at any time, by mistake or improper working of the signals.

The interlocking between levers of the machine is confined to that between switch and signal levers only, and never (unless ordered so) between switch levers themselves. Signal levers are interlocked between each other through the switch levers, as will be described next.

Figs. 1, 2 and 3 will make clear the general construction of the machine, and it is only necessary to explain that the framing is cast iron, the levers, valves, locks, etc., brass, and the top plate of hard rubber, as are the rollers lying horizontally over it. Each switch lever consists of a small brass lever keyed at the centre to a steel shaft which extends through a bearing formed in the front of the machine, a hard rubber roller lying horizontally over the top plate, and terminates in the three-way cock in the rear of the machine, with which it is fastened rigidly. The upper end of this lever is provided with a rubber handle, and the lever end extends down far enough to just clear a dog or latch (fig. 1, *A*) pivoted loosely under the machine and extending through its front directly under the lever. These latches perform the locking of the switch levers by the signal levers. In the normal condition of all signal levers, all of these latches lie in a notch cut in the locking bars (fig. 2, *B*) in front of the machine, and offer no obstruction to the movement of the switch levers; but the instant a signal lever is moved from its normal position the latches of all switches affected by it will be raised so as to cause the ends of the switch levers to strike them and prevent them being moved far enough to open the valves operating the switches.

The rubber rollers referred to as forming part of the switch and signal lever spindles are cast rigidly thereto and provided with a series of metallic strips or collars (fig. 3, *B*), extending part way around them, their ends terminating each in one of the six slots cut the full length of the roller parallel with its axis. These strips are not all put on in the same relative position with the centre line of the operating lever, but are staggered, so as to either make or break their contact with the upright ends of the strips (fig. 3, *C*) on the rubber plate running parallel with and directly under them, when the roller is rotated by movement of the switch lever. To one end of each of these strips on the rubber plate the controlling wires to the various signals run and the other ends are joined together and run to one common battery supplying all signals. The other pole of this battery is connected to the main air pipe, which is used as a common return for all circuits. The breaks in each one of these strips are controlled by the levers operating switches over which the signal thus controlled gives right of way; and also by one or more signal levers as the interlocking may require. It will be very apparent that before the current to any signal can be established, all breaks in the strip carrying its current must be closed by the bands or collars on the rollers making contact between them. This is done by placing the levers in a position to properly set all switches for that signal. It will be also evident that in having moved a switch lever to close the strip for one signal, it will at the same time break the circuit at a strip controlling another signal requiring that switch in its original position. In this way, a very simple and effectual interlocking between signals is accomplished.

The strips on the rollers are so arranged that they make contact between the upright strips only when the levers are in their extreme positions, one way or the other. In order never to be able to move a switch lever from one side to the extreme stroke on the other side, and thereby close the circuit for another signal requiring that switch reversed, without any certain knowledge that the switch has moved, a device is attached to the rear end of the roller, which consists of a quadrant (fig. 3, *D*) secured to the roller by a set screw, and having cut through it above the roller a radial slot through which projects horizontally a peculiarly-shaped locking lever, provided with a small latch or tongue pivoted near its centre, and capable of a horizontal movement right and left on its pivot, but held in a central position, parallel with the lever on which it is pivoted, by a flat spring on each side. This latch, like the lever, extends through the slot in the quadrant and ends flush with the end of the lever. The lever with the latch thus arranged is pivoted in a suitable bracket fast to the machine, and connected at its far end with the armature of an electro-magnet (fig. 3, *E*), the circuit to which is controlled directly by the lock pin of the switch movement. This circuit is normally open, *i. e.*, when the switch is locked, and closed during its operation. The armature of the magnet, therefore, normally, hangs by gravity away from the magnet and keeps the end of the lever, projecting through the quadrant, elevated, so that a small steel pin in the centre of the upper inside slot of this quadrant, when the switch lever is thrown beyond *the vertical* position, strikes the latch or tongue and carries its free end with it as far as its construction will permit; the lever then will have been moved sufficiently far to have operated the valve, and consequently moved the switch, but not far enough to have made the contact between the strips controlling the signal. Before this is possible the switch must have been unlocked, moved, and then locked in the other position. The unlocking of the switch closes the circuit on the magnet, which becoming charged depresses the end of the lever projecting through the quadrant, into a recessed portion of the radial slot, holding the switch lever still locked thereby. At the same time, the small latch or tongue being thrown below the small pin which had carried it out of its central position, flies back, under the pin, into its central position on the other side of the pin. The latch and lever assume this position as long as the switch remains unlocked, but on being *locked* in the position moved to by the lever being reversed, the circuit is broken on the magnet and the quadrant end of the locking lever is raised from the recess in the quadrant and the lever thus unlocked is free to be moved to the end of its stroke, when the signal circuit becomes closed. Thus the closing of the signal circuit depends directly on, not only the movement of the switch, but the locking of it after it has moved. The electric locking of signal levers is effected by a similar, but simpler device, which consists of an electro-magnet whose armature, like that of the indication magnet, is connected to a horizontal lever fig. 3, *F*, pivoted in its centre, and its far end projecting through a locking quadrant fast to the roller, and engaging in such a manner as to lock it from being moved out of its centre position, if normal, or from being put normal, and thus release the switches locked by it, if out of its centre position, when the current to the magnet is broken through the circuit breaker of the signal controlled by that lever being at safety.

Directly above the machine is placed a miniature model of the tracks operated, fig. 3, *G*, and small movable switches thereon are connected directly to the rubber roller, so that after the indication from the switches is received, and the roller turned as far as possible, these small switches assume the position of the corresponding ones on the ground. In this way the operator can, at a glance, see the condition of his tracks at any time. In order to prevent an operator by mistake throwing his signal back to danger, and then his signal lever normal, and finally a switch, thus released, under or in front of a passing train, an interlocking relay, fig. 3, *H*, is

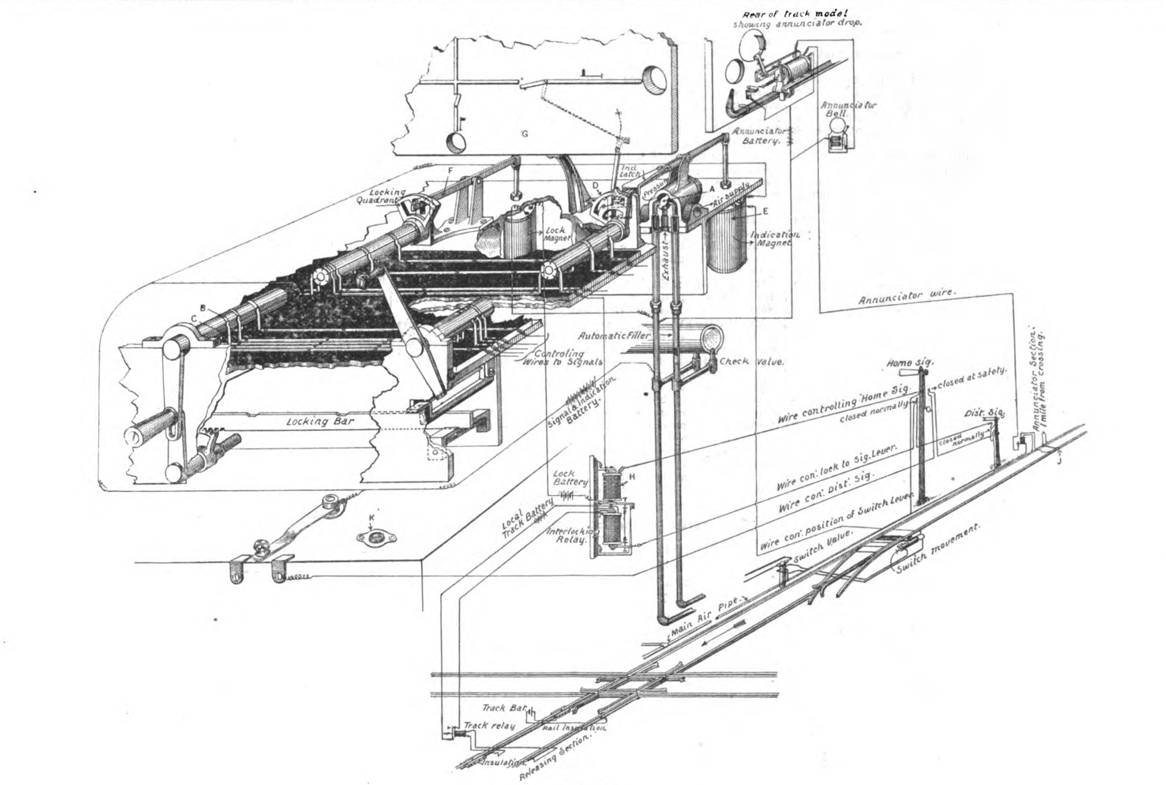


Fig. 3.

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included in the controlling signal and locking circuits, which, after the operator gives the signal, places the lever thus locked out of his control, in so much that while he has the power to throw the signal to danger at any time, it is not in his power to throw it normal and release the switches until the train has passed over the route set for it and cleared the last point of danger.

When within about one mile of the crossing, junction, yard, or of whatever the tracks interlocked consist, an approaching train automatically drops an annunciator on the rear of the track model, so as to display through an opening in the model board, fig. 3, *I*, a number or letter designating the track on which the train is approaching. At the same time, a bell begins to ring, and continues to do so until the train has passed over the short insulated section provided for that purposes, fig. 3, *J*. These drops are restored to their normal (obscure) position by a blast of air controlled by a small valve, fig. 3, *K*, in the front board of the machine, by the operator.

The advantages this system possesses over all others are numerous. Space required is limited, thus reducing size, and therefore cost of towers. The work is light, consequently female operators can be employed, thus reducing expenses. It gives great facilities for special locks. Large yards can be worked from one tower, as distance is of little object, switches half a mile away working as well as those close to the tower. There is no danger of signals being left at safety, as the machine remains locked until the signal has returned to danger. Any number of switches can, if necessary, be worked from one lever.

The following table shows the plants now in service:

Pneumatic Interlocking Systems in Operation.

Levers.	Location.	Railroads.	Put in service.
6............	Bound Brook, N. J..........	Phil. & Read. and L. V.	1884.
6............	Brightwood, Ind	I. V. and C., C., C. & I.	1884.
12 new style.	Wilkinsburg, Pa	Pennsylvania.	1884.
12 " "	East Liberty, Pa	Pennsylvania.	1884.
6 " "	Valparaiso, Ind..........	Chic. & Grand Trunk. P., F. W. & C. and N. Y., C. & St. L.	1884.
12 old style .	Stock Yards, Chi	C., B. & Q. and Stock Yard R. R.	1884.
14 " "	Erie, Pa........	L. S. & M. S. and Pitts. & Erie.	1884.
24 " "	Oakland, Cal....	S. Pac. R. R. Tower No. 1	1885.
10 " "	" "	" " " No. 2	1885.
6 " "	" "	" " " No. 3	1885.
24 new style.	" "	" " for " No. 1 shipped Dec. 8.	1888.
24 new style.	17th st. Pitts. Yd	Pennsylvania.	May 6, 1888.
*24 " "	14th st. "	Pennsylvania.	Aug. 19, 1888.

* At the 14th St. Pittsburgh Yard tower, the highest number of movements in 24 hours is 1,500, and the highest number of movements in one hour is 86. The machine is operated by one man,

Railroad Shops—New England Railroad Club.

At the meeting of Wednesday evening, Dec. 12, 1888, President Lauder occupied the chair, and announced as the subject for discussion, "The Arrangements of Shops and Machinery for the Construction and Repair of Railroad Rolling Stock," and that Mr. Marden would open the subject.

Mr. MARDEN: A railroad company can buy rolling stock at various shops that are established and run for the purpose, but it is more difficult to have the repairs of the cars and locomotives made at such shops, and it is economy for any road to provide good shops for the repairs at least of its rolling stock. I also believe that a road could build its cars, and I don't know but it could its locomotives, nearly if not quite as cheap as they can be built at most contract shops; and I know the road would be as well satisfied with the cars it built in its own shops. I say as cheap, meaning of course if they have equal facilities, and shops and machinery arranged conveniently, from the fact that the principal part of the expense of a car is in the material, the labor performed being but a very small part of it. The arrangements of the shops must depend largely upon the land that the company may own to place them on. Different plots of land would require different locations of shops, and while the round-house plan might be suitable for one plot of land, shops on either side of a turn-table might be better for another plot of land. There are advocates both for the round-house plan, and also shops located on either side of the transfer table, for the repairs of cars. At one time I thought that the round-house plan would be very much the best, especially for repairs of cars, but after looking the matter over carefully I have changed my mind, and I believe that if the land is suitable, that shops for repairs or for construction of cars are quite as convenient, and perhaps more so, arranged with a transfer table.

Among the most important things to consider in car shops is the width. I think the mistake has been made by many in making the shops too narrow, and also in making them too small—that is, the entire number of shops too small, building them for present use instead of looking forward to the increase of the business. I don't think shops should be made less than 100 ft. wide. The length, if they are built with a transfer table between them, or one side of them, may be optional, whatever length may be desired, to take care of the amount of rolling stock there may be.

There is another consideration which has been overlooked to a large extent, and that is light. I would have the largest amount of glass practicable in the shop; I would have all the daylight possible let into it consistent with the strength of the buildings, for I believe daylight is a good deal cheaper than any other light we can use.

In the arrangement of tools, especially in the wood-working shop, I think a building that is perhaps 50 to 60 ft. wide or more, and sufficiently long to do the work, is better than a square building. I would make it fully as long as required for the work, and then I would arrange the wood-working machinery so that the lumber as it came into one end would pass continuously down through the shop to the different machines until it was ready to go into the car, and from there pass by the shortest route to the place where it is to be used in the car. The machinery for the lighter work could be arranged as thought best, but I would have the machines that are intended to get out the frame part of the car so arranged that there would be no backward travel for the lumber. In the matter of machinery, I think that a road could almost afford to throw away its machines once in five or six years and buy new machinery, on account of the improvements made in it. I think it is a mistaken idea that we must run a machine until it has run out before we can buy a new one, especially if there are new machines that will do twice or three times as much work as the old ones.

I don't know as I can do better than to call your attention to the plan of the shops that our road is building now at East Fitchburg, as it will show you my idea more clearly of what I think we ought to have for shops on the Fitchburg road, on the plot of land that we have assigned to that purpose, a level plot on the side of our main tracks running towards Fitchburg. The shops are designed to be four in number, that is, the working and repair shop, with a transfer table between the freight repair and freight erection shop, and one between the passenger and paint shop, with a suitable number of tracks in each shop; in this instance we have 24, by which we can either put the cars into the shop or on to the transfer table. The lumber will come in at one end of the shop and will pass on from one machine to another, and when it goes out will be ready for the erection of freight cars, and will be taken to the various shops where it is to be set up. There will be a covered passageway from the second story of this shop into the passenger erection shop. At the end we have our dryhouses. [Mr. Marden further explained the plan, pointing out the location of the upholstery and furniture room, the arrangement of the transfer tables, etc.]

We have carefully studied the subject of flooring in connection with our shops, and have finally concluded that a concrete floor will be, perhaps, best for the paint shop, and all other shops except the blacksmith's, and for that plank for the under floor, either yellow pine or spruce, with about one and one-eighth inch of yellow pine floor on top of that. Our idea is that if the top board should wear a half or three-eighths of an inch, or to such a depth as would require its removal, it would be easier to remove the thin flooring than to take up the planking, and much cheaper for the company.

The PRESIDENT: There is one very important matter I would like to hear discussed; that is, the size of the building and the location of the machinery in it; I mean in the building where the wood-working machinery is placed. Mr. Marden suggests a long, narrow building. I suppose that he would run cross shafting from the main line, and have his machinery set lengthwise of the shop. My own idea is that it would be better to widen that shop to a 100 ft., and let one line of shafting run through the shop, and put the machinery crosswise of the shop. I presume there are gentlemen present who have had experience in that direction, who could tell us just the most convenient way for getting out lumber for the construction of railroad cars. It seems to me that by putting the machinery crosswise it could be so arranged that the lumber could start at one end, and pass back and forth through these machines much more conveniently than it could if the machinery were placed lengthwise of the shop. Mr. Adams has some very good shops at Allston, built late enough to be modern, and I would like to have his ideas about the location of machinery.

Mr. ADAMS: As the President suggests, we have some shops that are tolerably well fitted, or were at the time they were built, for the wants of the road, more so than they are just at present. In regard to the location of machinery, whether it should be lengthwise or crosswise of the shop, that depends almost entirely on the circumstances and conditions which prevail. If I could arrange a shop with everything else equally as convenient, and at as small an expense, I think I should prefer my machinery to be placed crosswise in the shop, and principally for the reason that you get along in that manner with one line of shafting through the centre of the shop. I think it depends a good deal upon other conditions, upon the manner in which you get your lumber into the building, and the manner in which you get it out and into the erecting shops, and other considerations, so that it is a very difficult thing to plan a shop for one road just like one for some other road. As our shops were situated, it was necessary to make a continuous line of long shops; they are too narrow, but when they were built cars were much shorter than they are now, and we could build two freight cars on our track in our freight erecting shop, while now we can build but one. A passenger car 45 ft. long was a long car