

The Relief Department of the Pennsylvania.

The ninth annual report of the Relief Department of the Pennsylvania Railroad, which is just issued, is in many respects a remarkable document, as showing the magnitude and the success of this department which may be termed a departure from ordinary business methods. It is, however, a departure the character of which is coming to be recognized as strictly consonant with the best business principles, although in its inception the Pennsylvania officers were largely actuated, no doubt, by philanthropic motives.

This department was inaugurated in 1883, and provides for contributors, at a moderate cost, certain allowances or "benefits" when they are sick or suffering from accident, and certain payments to their families or designated beneficiaries when they die. Membership is voluntary, and the number has grown from 19,962 at the close of 1886 to 33,405 on Dec. 31, 1894.

The latter number comprises more than half the employees, many of the remainder being ineligible on account of age or physical condition.

The surplus now amounts to \$273,751, but it is still insufficient for establishing a superannuation fund on a firm basis. The subject, however, is receiving the earnest attention of the Advisory Committee and of Superintendent Anderson. The death rate during the year was equal to 11.5 per thousand members, and the average number constantly disabled was equal to 32.3 per thousand.

Simultaneously with the report the company has issued a pamphlet describing the department and stating in a plain way the results of the past nine years. The sums shown to have been received and paid out strike the reader as something enormous. The revenue of the relief fund is stated as \$4,919,011. In the distribution of this in benefits men disabled by accident have received \$722,565. To the sick has been paid \$1,287,230, and the death benefits have amounted to \$120,944 for accident cases and \$1,279,215 for death from other causes. The total benefits amount to \$3,709,945.

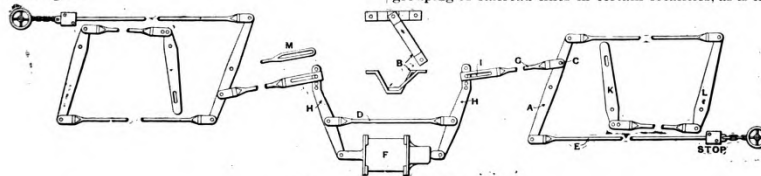
The financial statement shows that there is on hand \$195,935 subject to payments of liabilities and that there is a separate surplus fund of \$273,751, which has been set aside as a basis for a superannuation fund which it is intended to establish.

No operating expenses are paid from the fund, all these being paid by the company, which also supplies office and transportation facilities. The actual cash paid by the company for operating during nine years is stated at \$636,555, in addition to \$136,645 paid by the company through the Relief Department for aid to its members who remained sick after exhausting their title to benefits under the regulations governing the Relief Fund. The total payment for sickness has been nearly double the amount paid on account of accidents and the amounts paid for death from ordinary causes have been over three times as great as those paid for death from accident in the service. To show the moderate cost of membership in this association it is stated that a member may draw for sickness, in one year, as much as his dues would aggregate in 16 years; and that the death benefit is equal to the dues of 28 years; and the safety of the insurance is practically guaranteed by the Pennsylvania Railroad Company, with its 129 millions of capital.

The Employees' Savings Fund, which is entirely distinct from the Relief Association, now has 4,112 depositors. The amount received during 1894 was \$366,015 and the amount of money in the fund \$1,354,595.

Dickinson's Brake Rigging.

Mr. G. W. Dickinson, General Superintendent of the Northern Pacific, has applied to some passenger cars of that road a new arrangement of brake rigging, by which the air-cylinders and the hand brake-wheels can be operated simultaneously without danger or inconvenience, and a patent has been obtained upon it. The operation of these rods and levers will be understood by reference to the accompanying drawing, in which *A* represents a lever, which turns upon a fixed fulcrum at its center, instead of being a floating lever, as it is in the ordinary Hodge arrangement; the rod *I*, having a slotted end, is the connection between this lever and the main connection with the air-brake cylinder, and *H*, *H* and *D* are the main levers for equalizing the air-pressure to the separate trucks. *M* shows a side view of the slotted end *I* of the lever *G*. (The parts at the left of the drawing are duplicates of those at the right.) The bracket for supporting the rod *A* at its center is shown in the upper central part of the figure.



Northern Pacific Brake Rigging.

It will be seen that by the introduction of the loose connection at *I* the hand-brakes on the opposite ends of the car are disconnected, so that each brake-wheel controls only the truck on its own end. By introducing the fixed fulcrum at the center of the lever *A*, and by mak-

ing the power-connection through *H* and *G* to the point *C*, the application of the air, instead of pulling on the hand-brake lever *E*, as it does in the ordinary arrangement, has no effect on *E*; thus whenever the air is par-

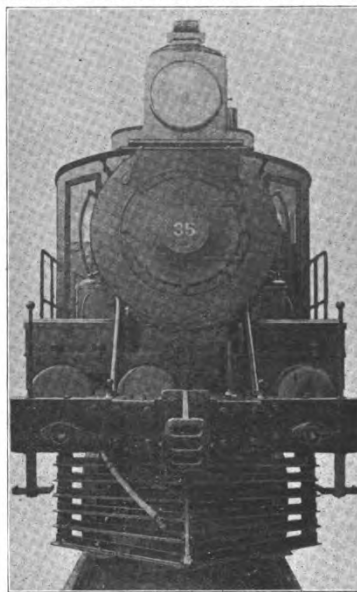


Fig. 2.—Smith Three-Cylinder Locomotive.

tially applied the brakeman can produce additional pressure by the hand-brakes, if that be found desirable.

When cars have been placed upon a side track the brakeman can wind up the hand-brake chains and set them so as to hold the brakes on after the air shall have leaked off. By the use of the slot *I* in the end of lever *G* the brakeman is enabled to apply the brakes without wasting energy on the air-cylinder or its connections.

We understand that this arrangement has been introduced on some or all of the through passenger trains of the Northern Pacific. The road has seven mountain summits, approached by 116-ft. grades, so that it is necessary to manage the air-brakes in the most careful manner. Experience on these grades has shown that the necessary bleeding of the air-cylinders before attempting to use the hand-brake is often very inconvenient; and by this invention it is done away with.

Track Elevation in Chicago.

In considering the present status of the movement for abolition of street crossings at grade in Chicago, it is well to take a brief retrospect of the entire matter.

Twenty railroad companies own and use rights of way into the city of Chicago. Some of these companies have

estate. In some cases the new lines paralleled closely the older lines, while in others the new lines made wide circuits around the outskirts of the city before taking aim at a depot. With the increase of freight business, connecting lines and belt lines have been built from time to time, so that at the present time the location of railroads in Chicago is about as complicated as it well can be.

As the population of the city increased so also did the business of the railroads increase, until an average of upwards of 350 people per annum were killed on the tracks of railroads in the city of Chicago. The local papers took up the appalling list of railroad casualties, and urged a separation of the grades of streets and railroads. Viaducts have been built at great expense, carrying the streets over the railroads, and many other viaducts have been ordered built.

Early in 1892 the following resolution was passed by the City Council: That the Mayor be and hereby is authorized to employ three experts, who shall examine the roads and construction of all steam railroads now centering in Chicago on grade crossings. That said three experts be appointed for the purpose of suggesting a remedy whereby grade crossings on all said terminal roads can be abolished by elevation or otherwise.

In accordance with the resolution Mayor Washburne appointed an ex-master mechanic, a real estate agent and an insurance agent as his Board of experts. This Board employed a bridge engineer, visited several eastern cities, and in July, 1892, made a report on the subject. In this report the Terminal Commission recommended that all railroad tracks be removed from the area bounded by Canal street on the west, Kinzie street on the north and Twenty-second street on the south, and that all other tracks be elevated sufficiently to clear all streets.

After this an ordinance was passed by the City Council requiring all steam railroads to elevate their tracks so that no part of the structure should be less than 16 ft. above the grade of the streets. In a certain district of the city this elevation was to be completed by January, 1895; in another district by January, 1897; and the whole was to be completed by Jan. 1, 1899. So far no work has been done by the railroads under the provisions of this ordinance.

It is not to be supposed that the railroad companies did not realize the seriousness of the situation. The constant and increasing expenses for maintenance of gates and watchmen at street crossings; the damage suits and verdicts for injuries and deaths; the delays and interruption of traffic caused by the numerous street crossings, all appealed to the managers for a remedy of the existing evil. The railroad officers did not make as much noise as the newspapers, but it is evident they kept up a deal of thinking.

The Illinois Central Railroad was the first one to accomplish anything in the way of track elevation. In 1892 an ordinance was passed by the Council and accepted by the railroad company, which provided for the partial elevation of their tracks south of Forty-seventh street, with a corresponding depression of the streets crossed, so as to allow bridging over the streets without excessive elevation of the tracks, which, between bridges, were carried on earth embankments. This work was completed in 1892, and as a result the Illinois Central Railroad has the finest approach to the heart of a great city that can be found on this continent.

The conditions on the Illinois Central were exception-

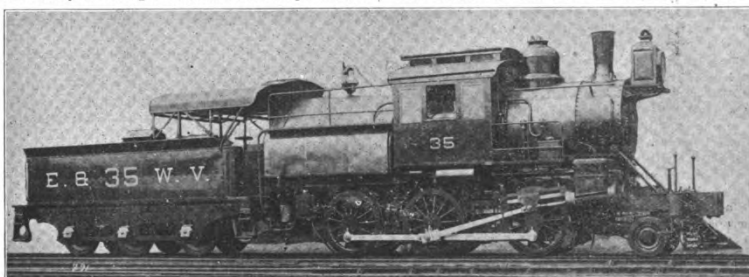


Fig. 1.—Smith Three-Cylinder Locomotive.

ally favorable for abolishing grade crossings. It crossed no railroad north of Grand Crossing, nine miles out from its city terminus; for a distance of over 5½ miles it was built along the margin of Lake Michigan, with no streets to cross; hence, there were less difficulties in the way and less time was required for negotiations than would be the case with any other railroad in Chicago. The World's Columbian Exposition willingly contributed \$250,000 toward the cost of the improvement, as it took the tracks off from the surface of their grounds and rendered access to the grounds safer and more convenient. Without this track elevation it would have been impossible for the railroad to handle the millions of passengers to and from the World's Fair that it did handle.

From Seventy-second street to the old station at Randolph street there is not a single crossing of a street at grade, and no railroad crossings, so that with its eight tracks the company is enabled to operate passenger trains at high speed, freight trains at any desired speed, and frequent suburban trains, making all stops, with safety and convenience. The incline in the railroad tracks com-

mences at Forty-seventh street, the first undergrade crossing is at Fifty-first street, and the last one at Sixty-seventh street; the foot of the incline joins the original grade of the tracks at Seventy-second street. In all there are 12 subways for streets, two for parkways, and one for foot passengers only. The total cost of this track elevation was approximately \$1,360,000, and the length of the raised track is 2½ miles.

The next companies to take active steps toward track elevation were the Lake Shore and the Rock Island. These companies own and operate jointly the line from the Van Buren Street Station to Englewood, a distance of six and one-third miles, where the tracks of the two companies diverge to the southeast and southwest respectively. An ordinance requiring the elevation of these tracks south of Sixteenth street was passed by the City Council in June, 1894. It was promptly accepted by the companies, and work was begun as soon as plans could be prepared, and continued up to late in December, when the severe winter weather put a stop to construction of masonry and raising of tracks.

At present the condition of the work is as follows: Four tracks have been raised on earth embankments to the new grade, from the crossing of the St. Charles Air Line, near Sixteenth street to Twenty-first street, thence the tracks descend on a steep temporary grade to the original surface; steel plate girder bridges with solid floors have been built over Archer avenue, Twenty-second and Twenty-third streets. These bridges are supported on abutments of masonry at the street lines and steel columns at the curb lines. It is reported that the remaining bridges will be built with a clear span from abutment to abutment, omitting the columns at the curb lines.

The entire work contemplated in the ordinance is to be completed in 1899, and it appears as if the railroad companies were carrying out the provisions of the ordinance in good faith. The ordinance requires that the elevation should continue to Englewood, where the tracks of the two roads diverge, and also on the line of the Lake Shore Railroad to a point beyond State street, and on the Rock Island to a point beyond Sixty-ninth street, about seven miles from the Van Buren street station. The ordinance does not provide for the elevation of the tracks north of the St. Charles Air Line. Here the situation is complicated by the crossing of the tracks of the Chicago & Western Indiana Railway, as well as those of the Air Line, and these, with their connecting curves, make an exceedingly difficult problem to handle.

The ordinance provides for depressing the streets at the subways, distances varying from 2 to 9.2 feet, generally not over 3 feet. There are 37 of these subway bridges required. The most difficult and expensive bridges will be those at State street, where an extensive yard is crossed on a skew, and at Wentworth avenue, where the Rock Island crosses a wide street at a very acute angle, with other streets joining the avenue close to the crossing.

The tracks of the Pittsburgh, Fort Wayne & Chicago Railway cross those of the Rock Island at grade near Sixty-third street, and as the elevation of the Rock Island tracks is to be but 10 feet, something will have to be done with the tracks of the Fort Wayne road in order to make this elevation practicable. An ordinance for the elevation of a portion of the tracks of the Fort Wayne road has been prepared, and is now in the hands of a Committee of the City Council, and will probably be reported and passed before long. This ordinance, as proposed, calls for the elevation of the tracks 12 feet at the north line of Fifty-fifth street Boulevard, the inclined approach to begin at some point in the yards north of Fifty-fifth street, the elevation to continue to the east line of State street, with an incline returning to the present grade of the tracks at some point further east. The total length of the proposed work, including the approaches, will be two and four-tenths miles. Subways beneath the tracks are to be constructed at Fifty-fifth street (this is a boulevard 200 ft. wide), Fifty-seventh street, Sixtieth street, Maple street, Sixty-first street, Chestnut street, Princeton Avenue, Sixty-second street, Wentworth avenue, Sixty-third street and State street. Some of these streets cross obliquely. The depression of the streets called for is generally between 2 ft. and 3 ft., but at Sixty-third and State Street the depression is to be 9 ft.

Viaducts now carry the streets over the tracks of the Fort Wayne road at Twelfth street, Eighteenth street and Thirty-fifth street. No satisfactory arrangements for the elevation of the tracks of this company north of Fifty-fifth street have as yet been agreed upon, but this is mainly because the Western Indiana has not agreed to carry out its part of the work. The proximity of the tracks of these two companies renders it impracticable to abolish street-grade crossings on one road without doing the same with the other road simultaneously.

The report of Colonel Eilers, Consulting Engineer on track elevation for the city, dated Nov. 19, 1894, sets forth the situation clearly. He says: "The Pittsburgh, Fort Wayne & Chicago Railway extends from the Union Station at Canal and Madison streets due south to a point near Sixtieth street, then curving to the southeast, it pursues the latter direction to the Indiana State line, a distance of 14.7 miles. Between the Union Station and Twentieth street the roadbed and right of way is owned and used jointly by the Fort Wayne and the Chicago & Alton Companies, while from Twenty-first to Forty-sixth streets the right of way of the Fort Wayne joins the right of way of the Chicago & Western Indiana Railroad, the tracks of the two companies practically occupying and using the same roadbed and right of way to Forty-sixth street, immediately south of which they separate, the tracks of the Western Indiana Company curving to the west while the tracks of the Fort Wayne

Co. continue their southerly direction and finally pass into their yards at Forty-seventh street, which practically occupy the entire area between the latter street and the Fifty-fifth Street Boulevard, and between Tracy and Stewart avenues in an east and west direction. Within the present municipal limits the P., F. W. & C. Ry. owns and uses 96 miles of track, and the Chicago & Western Indiana system, which also includes the Belt Railroad, owns and operates 216 miles of track. South of Twenty-first street the tracks of the Western Indiana are used by the Wabash, Chicago & Erie, Louisville, New Albany & Chicago, Chicago & Grand Trunk, Chicago & Eastern Illinois, and the Chicago & Indiana Coal Railway companies. With the exception of the few blocks between Thirty-seventh and Forty-first streets, practically the entire distance on the west side of the right of way of the Chicago & Western Indiana Company, from Thirty-third to Fifty-fourth streets, is covered with the yard system and tracks of the C. & E. I., the Wabash, the L. N. A. & C., and the Chicago & Erie companies, the width of the same being from 100 to 800 ft. in an east and west direction. If the hazardous character of any crossing at grade is directly proportional to the number of tracks crossed and to the number and frequency of trains, then the many highway crossings at grade on this extensive railroad system, between Twenty-eighth and Fifty-fifth streets must be classified as among the most dangerous in the city."

In a tabular statement he shows the number of tracks of these two companies crossing the various streets between Twenty-first and Fifty-fifth streets, this number varies from 6 to 101, none of the streets between Forty-eighth and Fifty-fourth having less than 48 tracks crossing them.

Continuing his report says: "It is manifest that the removal of the crossings at grade within such limits will require concurrent action on the part of the Pennsylvania Company and the Chicago & Western Indiana people. It will be joint work and it should be commenced at an early day. The Pennsylvania Company stand ready to go ahead with their part of the work immediately, and they have been ready to do so for more than a year past. I regret to say that it is the Western Indiana Company that is holding back. It is admitted that the peculiar character of their position makes the question one of grave moment to them, both financially and otherwise, but I doubt if the obstacles in their way are insurmountable, and believe the problem presented for their consideration capable of successful solution. The tracks should be elevated to the maximum practicable limit, which, in my judgment, will be between 10 and 11 ft. throughout, exclusive of the terminal approaches and yard connections."

The St. Louis Extension of the St. Louis, Keokuk & Northwestern Railroad.

In the *Railroad Gazette* of Dec. 15, 1893, appeared an account of the work that was in progress for the purpose of providing an entrance into St. Louis for the lines of the Burlington west of the Mississippi River, and for the Missouri, Kansas & Texas, and for providing terminals in the city. This work was at that time in progress under Mr. George S. Morison as Chief Engineer and Mr. B. L. Crosby as Resident Engineer. In the January number of the *Journal of the Association of Engineering Societies* appears a paper under the title that we have placed at the head of this article, which is the address of Mr. Crosby as retiring President of the Engineers' Club of St. Louis. We give below some of the points of Mr. Crosby's paper, not, however, attempting to give the details at great length. A map of the line and its connections appeared with the *Railroad Gazette* article of Dec. 15, 1893, and is given in the article in the *Journal*.

The total length of this line of railroad is 42 miles. It is located with maximum grades of 26.4 ft. to the mile, and maximum curves of 3 deg. The full trains hauled over

deck plate girder, the substructure being piles in cylinders, the cylinders filled with concrete. Cast-iron caps on the cylinders form seats for the girders. In order to keep the slopes of the banks away from the cylinders the girders are continuous over the piers, and overhang about 10 ft. at each end, making cantilever arms; thus the length of the girders is actually 101 ft. over all. A sketch of one of these bridges is given in Fig. 1. The single track portion of the line is now ballasted with gravel, but will be ballasted this spring with burnt clay; the rest of the line is ballasted with broken stone.

Through St. Louis County, that is, south of the crossing of the Missouri River, there was a good deal of heavy

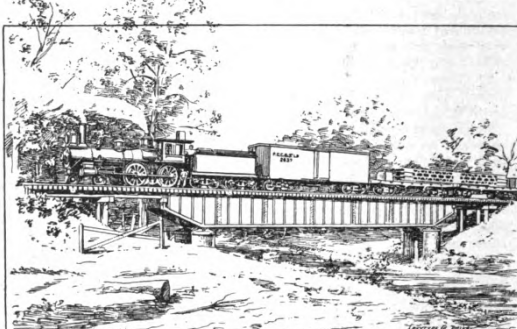


Fig. 1.—Cantilever Plate-Girder Bridge.

work, the deepest cuts being 50 ft. The ground here was very much broken by pot holes, with no valleys that could be followed. With two exceptions all of the county roads are carried over or under the tracks. The culverts, with two exceptions, are cast-iron pipes from 24 to 48 in. in diameter. Of the two exceptions one is a 10-ft., brick barrel culvert with foundation and supporting side walls of concrete. The other, the Coldwater arch, is novel and an engraving of it is given in Fig. 2. The bed of the stream at the crossing is on solid limestone rock and on the north side is an abrupt bluff of limestone, rising about 25 ft. above the bed of the creek. It was decided to put in an arch here and carry the road over on a solid bank. The bluff was cut away enough to carry the creek through at right angles to the line of the road and an arch of 20 ft. radius was constructed, one side springing from the rock at the bottom of the creek and the other from a rough skew-back cut in the rock about 16 ft. above the true springing line of the arch. The arch is 90 ft. in length, built of hard burnt brick, laid in Portland cement, and 36 in. thick. The haunch walls are of Louisville cement concrete. The head walls at each end are brick, with stone copings.

Yards in St. Louis.—The main freight yards, which begin about two miles south of the city limits, are particularly interesting. This work was especially mentioned in our former article. About 500 acres of land is owned here by the company and at present 30 miles of track has been laid in the yard, which can be used as a gravity or poling yard. Here are a roundhouse, coal chute, freight house, oil house and warehouse. The roundhouse is built for 40 stalls, but only 30 have been built now. There is a steel turn-table 66 ft. long.

Across the northern half of the yard runs Harlem Creek, which was very devious in its course, and over which all the tracks of the yard had to be carried. It was decided to change the channel and run the creek straight to the river. Borings showed that rock for foundation could be got at from 30 to 24 ft. and above low water in the Mississippi. It was decided to build an arched culvert to carry the creek. This culvert or sewer, Mr. Crosby thinks, is larger in area than any in the country. The bench walls are 30 ft. apart and are of limestone and cement masonry backed with cement concrete. The spandrels are of concrete. The bench walls vary in height from 6 to 11 ft. The face stones average 2½ ft. deep from the face, with headers every third stone, not less than 3½ ft. deep. The top course is cut in the form of a skew-back to take the arch. These bench walls were built by the company from the Mississippi River to the western limits of the property, 1,560 ft., and have been continued by the city to connect with

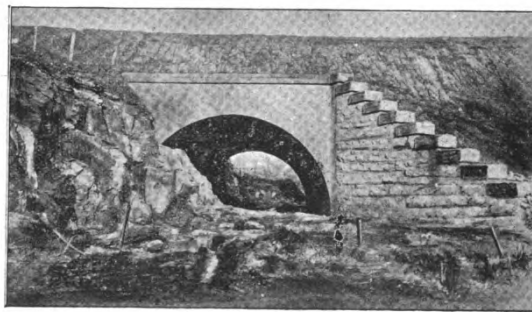


Fig. 2.—Coldwater Arch.

the old lines can be brought through to St. Louis without doubling, whereas while the entrance was by the way of the Wabash the trains hauled to St. Peter's had to be broken up into two trains before entering St. Louis. The first 24 miles of the new line, after its departure from the old line, is single track; the rest of it, into St. Louis, is double track. Two small streams are crossed by bridges which have a novel feature. These are each an 80-ft.

the water-works arch over the Harlem Creek. The arch is of hard-burnt brick laid in Portland cement. It consists of seven rings, with a total thickness of 32 in. It is segmental, has 16 ft. radius and 11.43 ft. rise. The arch was turned only within the limits of the yard now built, that is, 607 ft.; but the bench walls are complete the whole length and the arch may be continued when needed. This culvert contains 6,000 cu. yds. of concrete,