A FEW NOTES ON EARLY ELECTRIC RAILWAY WORK IN PITTSBURG.

BY LEO DAFT.

One day during the summer of 1886 a bright looking young man was ushered into the writer's office, adjoining the factory, then situated at Greenville, N. J., with the remark, "This gentleman wants to get a few particulars about the maximum gradients it is possible to ascend with electric motors, and the New York office has just called us up to know if you cannot show him some experiments in that direction."

A few questions elicited the information that the young man hailed from Pittsburgh, Pa., and was bold enough to propose the construction of a street railroad, some 1½ miles long, with a total ascent of nearly 500 feet, and a maximum gradient of over 15 per cent, part of which was necessarily on a curve of short radius.

The average gradient for the entire line exceeded 6 per cent, and an examination of the profile of the proposed route revealed the interesting fact that there was not anywhere a sufficient stretch of track to store half a dozen cars without the brakes set, while the plan with its ten curves, three of less than 38 foot radius, on a 5-foot 2½-inch gage were salient features in the list of perplexities calculated to satisfy the most exacting seeker for trouble, and which had certainly not then anywhere confronted builders of mechanical tractors. If it has since been equaled in that respect, except by mountain railroads with special rack devices throughout, may well be doubted.

The prospect was so far from inviting that had it not been of vital importance to secure new business, our young friend's enterprise would have been "politely but firmly" declined, but an acquaintance of some three years with the kind of propositions then being offered to us and to the one other firm which was at that time commercially launched in this field, led to the conviction that only two kinds of street railway promoters were rash enough to tempt Providence by espousing the cause of electricity, namely, those having roads in a condition of financial decay, and others with plans over routes presenting topographical features of a prohibitive character.

After seeing various experiments, among which was the repeated ascension of a gradient equal to 2,900 feet per mile by a small motor car, with one passenger, from a state of rest without sprocket or other gripping devices, the bold young man departed in triumph. The outcome of this visit was a contract with the Daft Electric Company, to equip the Pittsburgh, Knoxville & St. Clair Street Railway (as soon as it should have its permanent way built) with five motor cars capable of towing a fully loaded trailer at an average speed of not less than six miles per hour up the incline, and at not less than three miles per hour on the heaviest grades; together with dynamos and all electrical station equipment. The problem was not then easy of solution and was rendered more embarrassing by the clause requiring the contractors to build a double track conduit of some 800 feet in length, near the city terminus, and change the method of supply without stopping. Why this latter clause was inserted it is difficult to imagine, since the street along which the conduit ran was so far from attractive or picturesque that the invasion of a well loaded clothes line would have occasioned little more than passing remark, but in those days the few electric railroad advocates were nearly everywhere assailed by captious councilmen or impecunious owners of abutting property, either with demands for fanciful construction on the one hand or a substantial interest on the other, before allowing a few more poles to deface the classic beauty of a semi-residential street in a crowded manufacturing city. Suffice it to say, that an attempt to

LEO DAFT.

Leo Daft, whose name is as inseparably connected with the early electric railway industry in this country as that of Van Depoele or Sprague, does not need any introduction to our readers, for it is but a few years since the company bearing his name, and playing an important pioneer part in electric road building, passed out of existence. It is hard to realize that the history he relates is that of events taking place only ten years ago, and less. The industry has grown fast, and the army of new men that have come in know little of the history of the pioneer undertakings. As Mr. Daft hints in his article, much of the "history" that is written these days is hardly worthy of the name, and it will be especially gratifying to ou readers to hear from such an absolute authority as he is. Mr. Daft himself, however, is too modest to speak the whole truth about his part in early work, and we hope that some day some writer acquainted with all the facts will publish a history of Mr. Daft's connection with the electric railway industry. When that is done, it will be found that by him were first tried many devices which are accredited to others. But perhaps the most notable fact of all is the way some of his early apparatus stood the test of time and service. To the man who could design and manufacture such apparatus when working under great disadvantages, we say all credit is due. But before closing these remarks relative to the work of the author of this paper, we want to call attention to the gross injustice that has unintentionally been done him and his work by recent writers who saw only the crudity of his early apparatus as compared with that of to-day, instead of appreciating its marvelous perfection, considering the state of the art at the time it was designed. Especially is this true of the electrical work on the Manhattan elevated. The locomotives there used were far in advance of anything else put out at that time. Mr. Daft is now at Los Angeles, and is carrying on a consulting and constructing engineer's practice on the Pacific coast, and an army of friends will join in wishing him peace and prosperity after his labors in behalf of the industry that feeds and clothes us all, and which has revolutionized modern life and communication.

modify the objectionable clause by substituting one calling for overhead construction with iron poles and elaborately decorated finials, with severe restrictions in the matter of span wires, etc., met with a reply which practically amounted to "conduit or nothing," so without more ado the work was begun.

In a winter climate of such severity as that of Pittsburg it was evident that long gradients of from 12 to 15 per cent could not be safely operated on an ordinary track. It was therefore decided, after some little controversy, that whenever the inclines exceeded 10 per cent, a center rack rail should be employed, and a sprocket wheel mounted on the motors so as to be capable of intermittent use. This consideration alone might have been sufficient to decide the question as to the mode of traction, but there were others which finally turned the scale in favor of independent motors, and five of these were required for the proposed schedule.

Owing to the usual delays in pioneer work, the actual construction of these motors was not commenced until the spring of 1887; and proceeded very slowly, from a

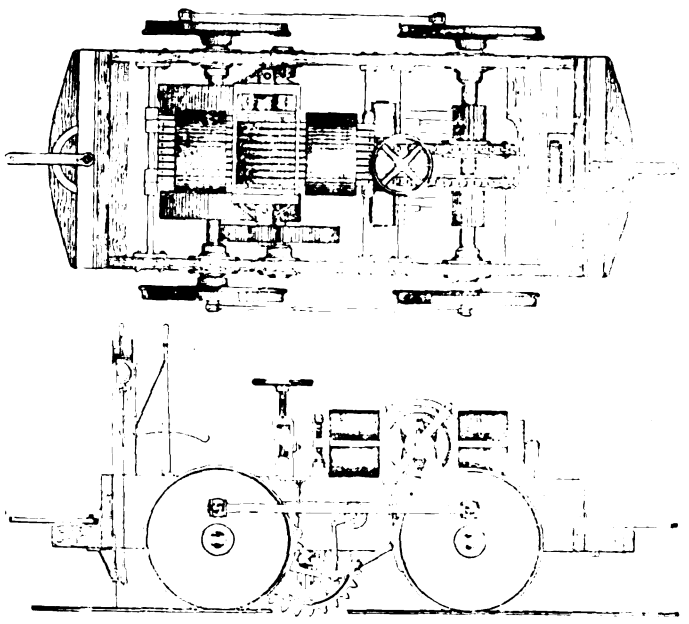


FIGURE 1.

variety of causes with which the pioneers who may read this will be all too familiar.

Referring to those tedious delays on the part of early constructors, it should be remembered that in one respect there were marked differences in the classes of pioneers, one class who merely originated special devices and depended upon established manufacturers for the greater part of the operating machinery, and another class who designed and manufactured every item of the machinery and apparatus for all the enterprises with which they were connected, thus suffering the continual embarassments due to training mechanics in unfamiliar lines, besides incurring the vexatious responsibilities which the acquisition of manufacturing facilities, however limited, had forced upon them as the very price of existence, and the support of their business associates. Of the latter class there were practically but two in this field, the Van Depoele Electric Manufacturing Company and the Daft Electric Company.

The finished weight of the independent motors was calculated to be about six tons, and the trailer, with forty passengers, added some five tons more, it was therefore

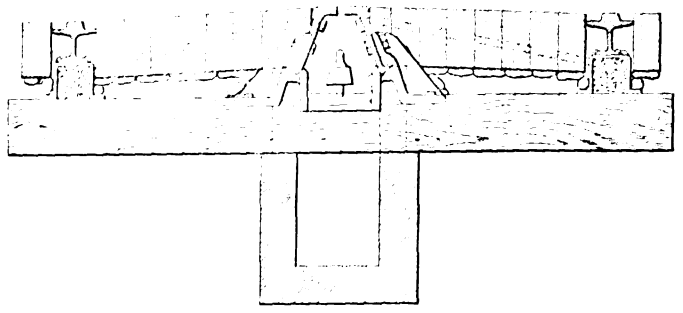


FIGURE 4.

decided to equip with motors of 30-horse-power, and accordingly five of these were built during the spring and summer of 1887.

The gearing was double reduction, the brakes toggle geared, and the 33-inch drivers were connected by side rods, quartered in the usual locomotive manner. The regulation was by means of commuted fields similar to those used on the "Ampere" at Saratoga in 1883, and at Baltimore in 1885, in neither of which cases were rheostats used at all.

Tests made before shipment at the factory, with a pressure of 260 volts, proved a development of about 32 horse-power for the unmounted motors, and when placed on dry rails the ultimate tractive effort of the complete mounted motors was found to be between 2,700 and 3,000 pounds. With the sprocket engaging the perforated rail, a pull exceeding 9,000 pounds was repeatedly registered.

The sprocket wheel shaft was connected with one driving-axle of the motor by heavy sprocket chains, and was lowered into or raised from the track by a wheel and screw on the foot board, as shown in Figure 1.

Meantime the work of track construction was slowly proceeding at Pittsburg under the Railway Company's supervision. The gage was 5 feet 2½ inches and the greater part of the rail was side bearing of 45 pounds section. Near to the city terminus was an abrupt descent of some 150 feet which was bridged by an iron trestle structure of rather imposing proportions, including gradients varying from 8 to 11 per cent; this bridge is well shown in the engravings Figures 2 and 3, as is also the perforated rail.

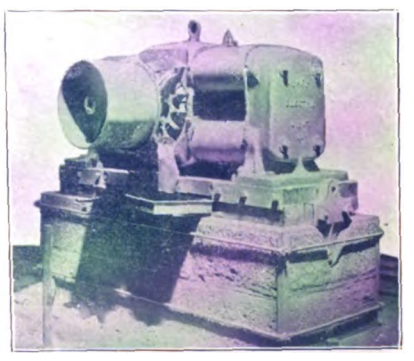


FIGURE 6.

A section of the conduit is given in Figure 4 together

with the center bearing rail used on that portion. The conduit was 800 feet long, double track with two cross-overs, and was built by the Wharton Company under contract. The conductor was of hard drawn copper 5/8-inch diameter supported on cast iron and hard rubber insulators at intervals of 4 feet, and placed directly beneath the slot, a distance of 6 or 7 inches.

The overhead system was of the bracket suspension variety, except across the trestle (see Figure 5) where two poles and a cross arm were adopted, and two number 000 wires were supported in a horizontal plane as a track for the four wheeled trolley, though both formed one side of the grounded circuit, the rails being bonded in the usual manner. The power-house, situated at the

FIGURES 2, 3, 5, 8, 9 AND 11 SHOWING THE PITTSBURG, KNOXVILLE & ST. CLAIR RAILWAY — THE FIRST ELECTRIC ROAD IN PITTSBURG — DAFT SYSTEM—OVER RUNNING TROLLEY.

upper terminus, was equipped with four 50-horse-power compound generators, supported on solid masonry foundations (Figure 6), and driven by a common slide-valve engine with double cylinders, 16 by 24, driving a flywheel 10 feet in diameter, 32-inch face, at 130 revolutions, which was belted to a jack shaft and back from four pulleys, each 6 feet in diameter, to the dynamos which were speeded to 1,050 revolutions. The latter were used in parallel series, and the pressure was from 260 to 280 volts.

Automatic magnetic circuit breakers, as shown in Figure 7, were used at the power house and head of conduit.

Owing to demands for machinery to equip other roads the first motor was not shipped from the factory until the latter part of August, 1887, but arrived in Pittsburgh long before the track was fit for operation, and from various causes it was not until the following March that the road began carrying passengers. The succeeding four or five months were full of tribulation for both operating and construction companies, as might have been expected; not a little of the difficulty being attributable to the frequent failures of insulation in the conduit and the well known peculiarities of the Pittsburgh climate, it being by no means uncommon in that region for drenching rain to fall for hours and freeze as it reaches the ground, forming a thick layer of tough ice exceedingly difficult to remove. Witness, the following quotation from engineer's report late in December, 1887, "I ran No. 5 up to the power house last Saturday and had a pretty rough experience, as the rain was pouring heavily and froze on the rails, making it necessary for us to chop the ice off ahead of the motor in order to get a rail contact. We were from 4 to 9.30 accomplishing the feat." But after heroic efforts and the most admirable skill, intelligence and self-sacrifice on the part of the engineer in charge, Robert McA. Lloyd, the road was gotten into fairly regular service and remained in operation until the winter of 1890, when the franchise and other property were purchased by the Birmingham Traction Company, which wisely abandoned the lower portion of the road, containing the heavy grades, and now operates that known as the "hill top" section only.

Illustrating the kind of track construction on this road the writer quotes from a report of the superintendent dated September 10, 1888. "The trailers were off the track twenty times yesterday, and, of course, the sprocket is all that keeps the motors on."

The engravings, 8, 9 and 10, from photographs made while the road was in operation, represent a few of the drastic doses which pioneers were wont to meekly, or even eagerly accept.

That quite heavy work was done may be gathered from the following quotations contained in informal reports of the superintendent: "Finding a core contact in No. 3 armature when she was down the road with a car, we took out No. 5 motor and pulled back a car load of people and No. 3 motor in tow. The whole train (17 tons) ascended the 12½ per cent grade with the usual speed and neither the motor or generators seemed to mind it. I'm not afraid to tackle any of the hills after that."

On one occasion a motorman neglected to let down the sprocket wheel while descending the 15.5 per cent

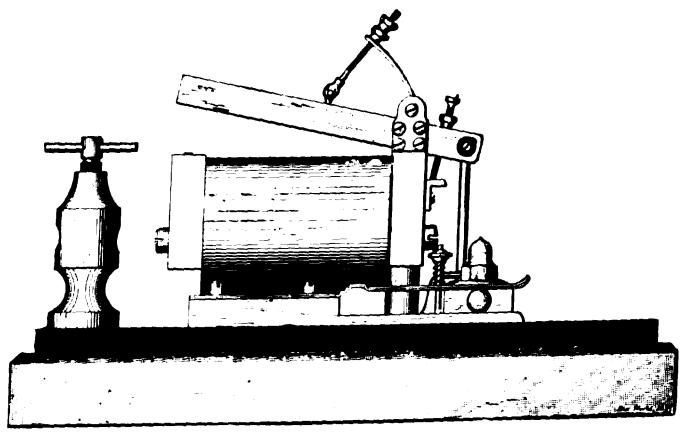


FIGURE 7.

gradient. The result is described by the superintendent as follows, under date August 15, 1888: "The motor and car, with all the wheels locked, slid to the bottom (over one-third of a mile) on a perfectly dry rail." Figure 11, showing motor and car on this grade, will give the beholder a quite vivid idea of that interesting performance.

Occasionally loads of over eighty persons were carried, when the motor would also be crowded to the great inconvenience of the long-suffering motormen, who not infrequently showed a devotion to their work and a stoical indifference to personal comfort, which one can only recall with grateful admiration, especially when it is considered for how small a pittance such work was, and is, usually done, unrelieved by the hope of extra reward which naturally stimulates the pioneer.

In the meantime Thomas A. Noble had been in negotiation with the Daft Electric Company for motors to run on a proposed suburban road of about three miles in length, beginning at the power house of the St. Clair

FIGURE 10.

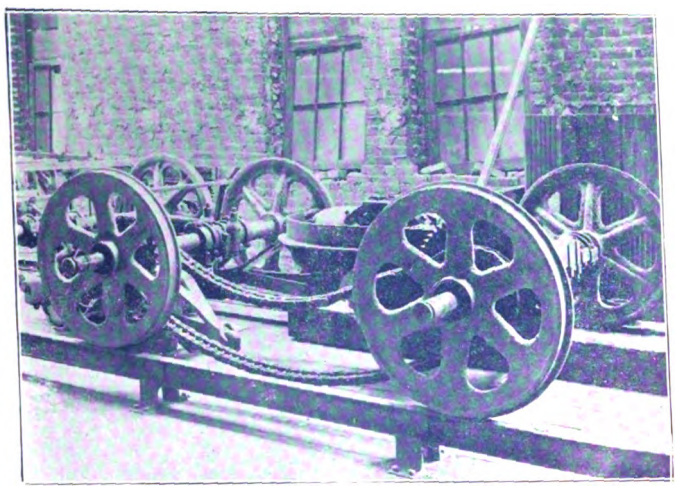


FIGURE 12.

road, and intended to develop a very pleasant residential region, besides affording transit to a large and beautiful cemetery some two miles from the terminus. Accordingly about November, 1887, an order was given for one-car motor equipment, and with truly characteristic energy and thoroughness Mr. Noble began the construction of his track, using a 45-pound T-rail and single pole bracket overhead wire line, consisting of two Number 00 hard drawn wires with rail return, as in the St. Clair road, and band copper bonding of about 130,000 circular mil section.

The first motor car was shipped in February, 1888, and was of double reduction gearing, with steel and rawhide pinions, the motor being suspended from the axles of the car by phosphor bronze bearings at the power end, and supported from the other end by an extended arm loosely fitting an under hanging link; the fore and aft wheels were connected by sprocket chain, as shown in Figure 12.

The car is represented on the track in Figure 13 from photograph made in May, 1888. This car was tested over the road with current from the Pittsburg, Knoxville & St. Clair power house, early in April, 1888, and the test was quickly followed by an order for another motor car of similar character, which was delivered during July of that year. The track of the Suburban Rapid Transit Company, by which name Mr. Noble and friends incorporated, was about three miles long, and though including among some heavy gradients one of 9 per cent. had few curves, and those of long radius. Being also of good construction, it was naturally a great relief from the rough St. Clair road, bristling with perplexities at every turn.

The contract required the motors to be of capacity to cover the lines, loaded, in ten minutes, or an average speed of 18 miles per hour, and though this could not be accomplished without dangerous coasting on the down grades, the performance of the cars was considered so satisfactory by the purchasers that they were not only accepted and promptly paid for, but more were ordered without delay. The usual trouble having been frequently experienced with the ever-exasperating sprocket chains, the writer decided to dispense with them entirely in the later cars ordered by the Suburban Company, and substitute quartered side bars. One of these 16-foot body, vestibule cars, was delivered in December, 1888, and immediately went into service. It was capable of making 18 miles per hour on a level, and 10 miles up a 6 per cent gradient. Five more of this type were ordered at short intervals within the following few months. Until July, 1891, the Suburban Company was supplied from the St. Clair power house, but in that month Mr. Noble completed his own power house, and the Daft equipments were rewound for a pressure of 400 volts, and the cars, which had previously been equipped with under contact devices, were braced for the heavier service of a contemplated extension. On the first of December, 1892, the extension of 1½ miles, into the heart of the south side, was completed ready for operation. The addition embraced one gradient of 12½ per cent and another of 6 per cent, of the extraordinary length of 5,850 feet, the total length of the grades being 6,450 feet. For over one and a half years, or until the early summer of 1894, the Daft single equipment, rated at 25-horse-power, with side rod connection, gave daily service up the 6 per cent portion of this gradient at an average speed of 10 miles per hour with a load of forty passengers. The writer simply quotes this statement from a recent report made by the president of the road, who adds in a letter dated September 11th, 1896: "Our present equipment is capable of making from 14 to 16 miles (on the 6 per cent grade.) Of course we are now equipped with two 30-horse-power motors, and we are using the Westinghouse, General Electric and the Walker." The succeeding remarks of this electric railway veteran might be of considerable interest to certain manufacturers of electric machinery, but one is not at liberty to quote further from his letter.

In December, 1894, two of the motors made by the Daft Company, which had been superseded in regular traction duty by heavier and more modern machinery, were mounted on a snow plow designed by Mr. Noble,

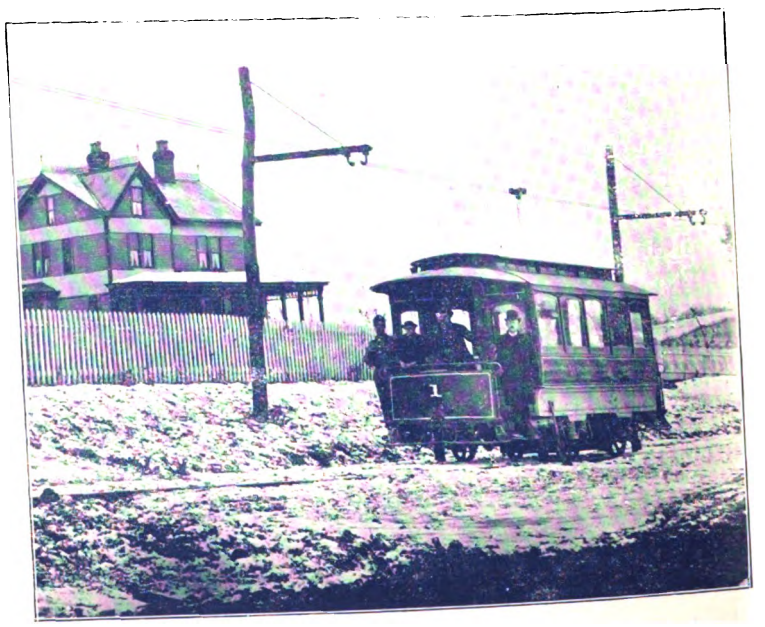


FIGURE 13.

the rest having been transferred to the Schenley Park and Highlands road some time previous. Again quoting from an earlier report of the managers, dated December 17, 1894, we learn that they had "built a snow plow using two of your equipments on a truck with 8-foot 6-inch wheel base and it makes a powerful snow plow. We propose to utilize the motors we take from the Schenley Park for the same purpose."

In addition to those until recently in active snow plow service there are two of the old motors still running in Pittsburgh at this date, (Oct. 1896), one is supplying power for a machine shop in the city and the other has been running a lathe in the repair department of the Suburban Rapid Transit Company for three years past. "The work is comparatively light, but it has been absolutely at no expense," says the president. It will thus be seen that the eight equipments supplied to this company in 1888 by the Daft Electric Company, remained in constant service for nearly six years, and some of them are still in harness.

It is pleasant to learn that a gentleman who was so active, intelligent and persistent an advocate of electric traction as was T. A. Noble at a time when it required no little courage and means to prove the faith that moves mountains, is now at the head of two important railway companies, and that his favorite venture, the Suburban Rapid Transit Company, has 4.5 miles of admirably constructed double track, a splendid modern equipment, and last, but by no means least, is carrying from 90,000 to 100,000 passengers per month.

Reference has so far been confined to the local work of the Daft Company, because the first contract for electrical railway work in the neighborhood of Pittsburg, was awarded to them, but in March, 1887, a contract was let by the Observatory Hill Passenger Railway Company of Allegheny City to the indefatigable pioneers, Messrs. Bently & Knight, which was the signal for a struggle as skillful and untiring as the historian of early electric railroad construction will be able to record, whenever some writer, without fear and without reproach, alike possessed of correct data and the courage to use it, shall take up the matter without the bias

FIGURE 14.

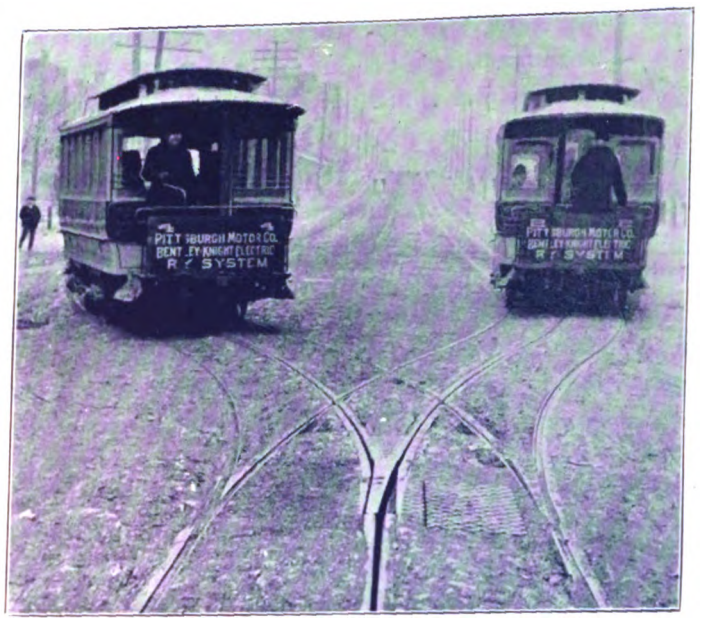


FIGURE 15.

born of affiliation with this or that "system." It would ill become the writer to reflect upon the several honest endeavors to record the early work in this direction, but that it is probably too recent for trustworthy data to be easy of access, may account for the resemblance of many historical attempts, with two honorable exceptions, to an old-time intermediate gear after encountering the ubiquitous monkey wrench on a down grade—judging from the gaps in them.

The distinguishing feature of the Bently Knight road was the ingenious metallic circuit conduit with which their names are inseparably connected, and which, in a somewhat less practical form, had been tested three years previously at Cleveland, Ohio.

The contract with Messrs. Knight & Bently required them to build several hundred feet of double track conduit. The exact data is not at hand, but the writer thinks it was something less than 1,000 feet and about three miles of single track with overhead conductor, on Perrysville avenue, Allegheny. The conduit was of the well known Bently-Knight design. The conductive system of the whole line was metallic circuit. The overhead lines were arranged about twelve inches apart, in a vertical plane, the contact being obtained by two single overrunning trolleys, similar to those used by Mr. Van Depoele. An excellent idea of this latter device may be gained from Figure 14, while Figure 15 well represents the junction of the double track conduit with the single overhead conductor section at the beginning of Perrysville avenue. The rolling stock consisted of five or six motor cars, equipped with motors built by the Thomson-Houston Company, and a substantial power house was erected containing Thomson-Houston dynamos, with high speed engines and a switchboard of quite unusual elaboration for those days.

Meanwhile the work of track and conduit construction was going on, and had so far progressed in March, 1888, as to admit of some preliminary experiments with one or two cars when, on the night of March 6, a fire

almost completely destroyed the power house and contents. The difficulties of conduit building in the severe and fluctuating winter climate of Pittsburgh, and the ever exasperating problem of insulation hitherto inseparable from the operation of them in such rigorous weather, had been sufficient to try men's souls without this added calamity, but the spartan resolution of the true pioneer was in these workers, and with a calm fortitude which compels admiration, they lost not a moment in again marshalling their forces with such good will, that after innumerable examples of the total depravity which has been the ruling characteristic of conduits on American soil, they experienced the crowning pleasure of seeing the road go into successful operation in July, 1888. But the end was not yet, for after varying success during the following winter, the conduit shared the fate of its kin in those days, by being finally abandoned after less than one year's service, and was replaced by an overhead system. After this change, and a resort to under contact devices, the road continued in successful operation for several years, and some of the motors are still in use on the Perrysville avenue branch, now in charge of the Pleasant Valley Company.

LEE SNOW PLOW.

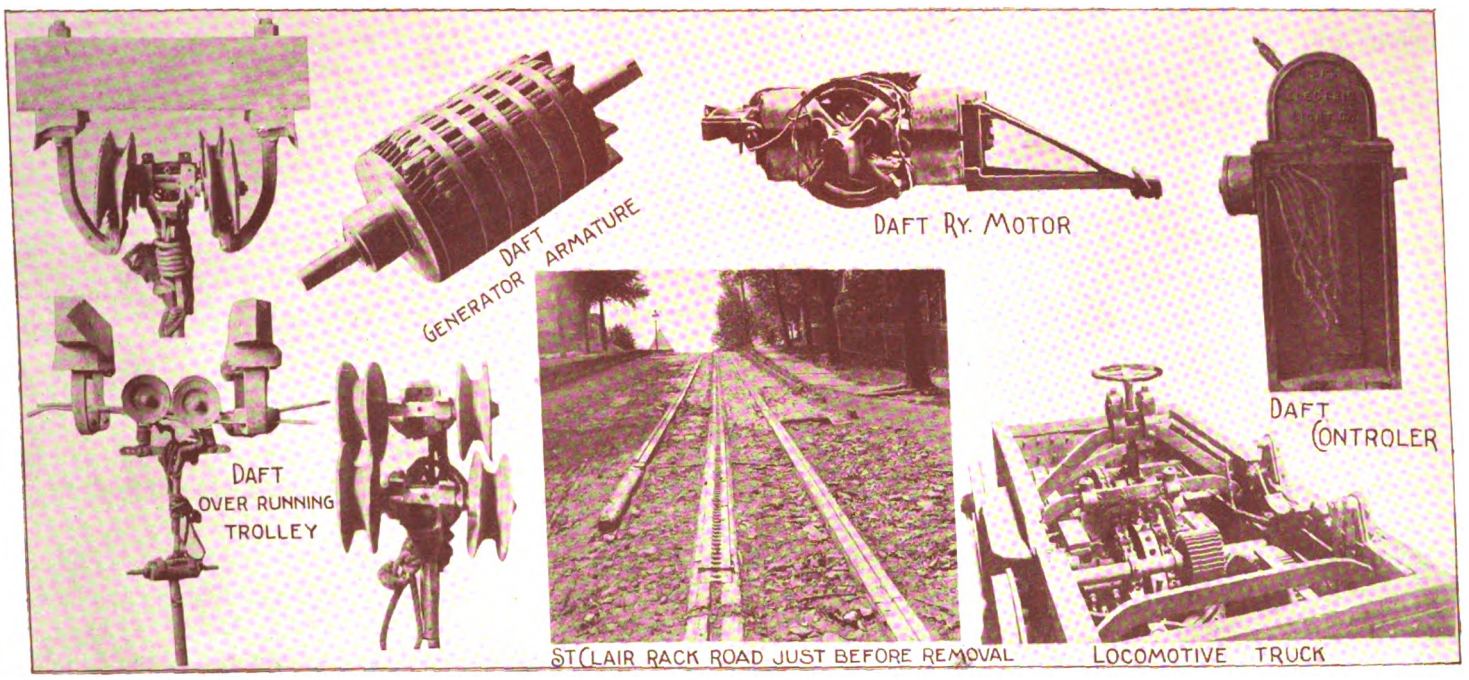
The Lee snow plow, manufactured by the W. E. Austin Manufacturing Company, Norway, Me., and of which an illustrated description was given in our issue of May, is now attracting a great many inquiries. The plow does exceptionally fine work in heavy drifts and is easily operated. It is now made in two sizes, with nose 37 or 48 inches in height. The frame is of 2½ by ⅝-inch Norway iron bolted to 4 by 8-inch rock maple. The covering is also rock maple, fastened with countersunk bolts. The cutting edge is of 5 by ½-inch steel, adjustable to take up wear.

THE KRUM DRAG.

A Traffic Inducer in Early Davenport Days.

When the first horse cars were run on tbe Brady street hill line in Davenport, many years ago, the company had difficulty in inducing people to try the car so fearful were they that the brakes would not hold it on the grade. On the day of the trial trip the whole town turned out to witness the opening, but the Davenport Democrat relates that not one of the spectators, not even the stockholders, would get in the car and ride up the hill. They were afraid that the car would run away backward down the hill taking the mules with it.

Finally, as a measure of safety, adopted mainly to reassure the unduly alarmed people, a device called the Krum drag was put behind the car. This was nothing more than a big crowbar dragged along just behind the rear wheels, and was intended to check the first impulse of the fiendish car to drag the unhappy team down to destruction by the tails. It was called a Krum drag, because it dragged and because it was added to the equipment as an inducement to get Chauncey Krum, then the most active man in the crowd, and a few others, to get in and ride up the hill. The drag worked like a charm. It was not needed to stop the car, but it quieted the host of fears that were tormenting Mr. Krum, and he entered the car with some of the rest of the crowd. When part way up the hill the car was stopped, and when it was seen that the brakes alone easily held it, even some of the directors who had followed the car on foot had confidence enough to get aboard, and thus regular service was begun with the confidence of all concerned.



RELICS OF EARLY DAYS.