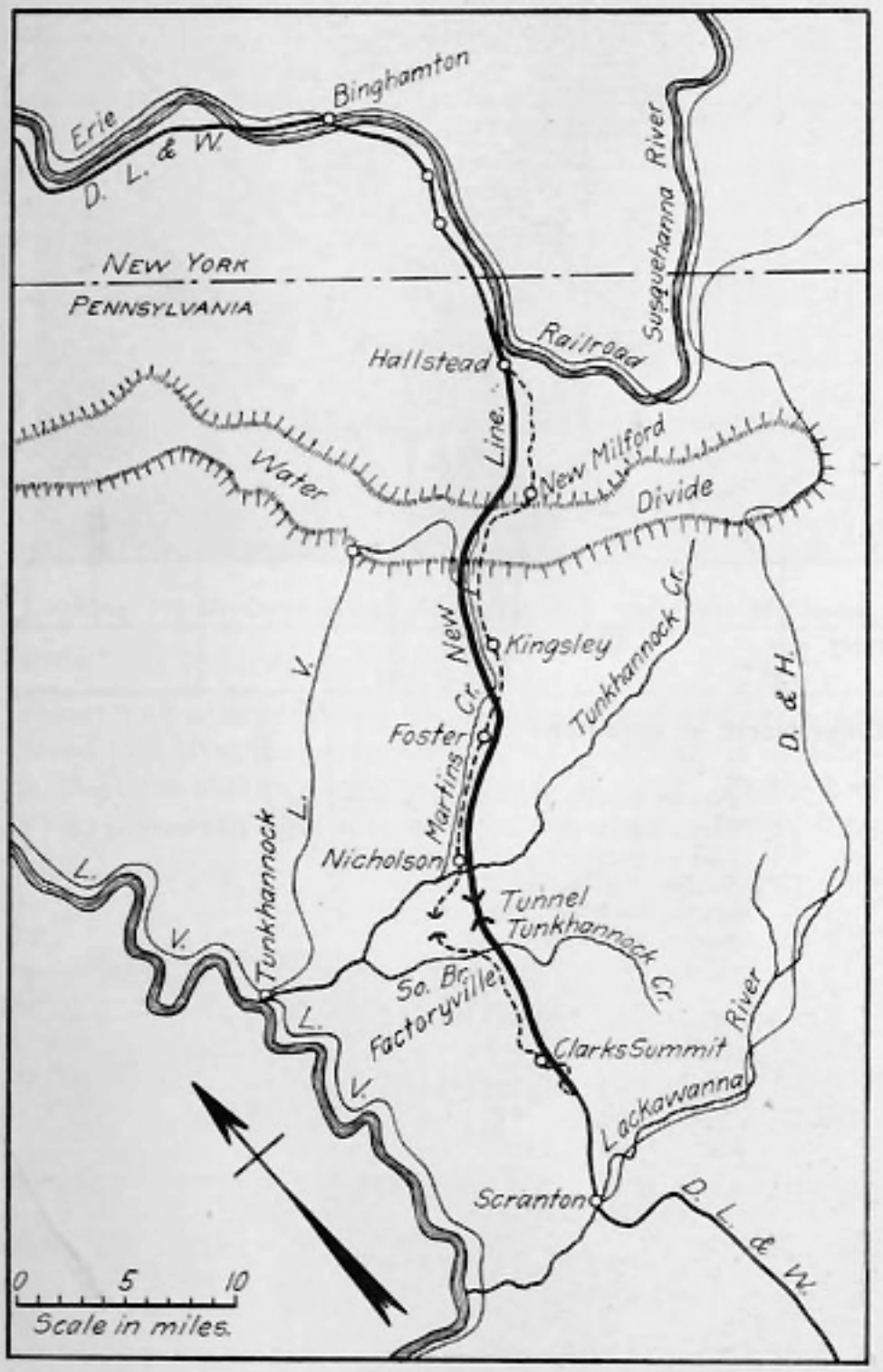
SUMMIT-HALLSTEAD CUT-OFF OF D. L. & W.

The First of Two Articles on a Forty-Mile, Three-Track Line Built on a New Location at a Cost of About $12,000,000.

A grade reduction project which involves some of the heaviest grading and concrete bridge work ever undertaken is now under way on the Delaware, Lackawanna & Western between Clark's Summit, Pa., about seven miles north of Scranton, and Hallstead, Pa., about 14 miles south of Binghamton, N. Y. A general description of this work was published in the *Railway Age Gazette* of April 25, 1913. Although contracts for this work were let early in the spring of 1912, and the contractors on all sections have pushed operations as fast as the best equipment



Location of New Cut-Off Between Clark's Summit and Hallstead.

and organizations have made possible, the grading is now only about 50 per cent. completed and bridge work 42 per cent. The following description will deal only with the grading and tunnelling. A second article to be published in an early issue will describe the early stages of the bridge work up to the present time.

In the 39.6 miles of new line the excavation quantities reach the high totals of 7,600,000 cu. yds. of rock and 5,100,000 cu. yds. of earth in addition to 146,000 cu. yds. of tunnel and shaft excavation, about 175,000 cu. yds. of earth and 31,000 cu. yds. of rock in masonry foundations and 250,000 cu. yds. of earth and 16,000 cu. yds. of rock for highway realinement, a grand total of 13,318,000 cu. yds., or over 336,000 yds. per mile of line. The total cost of the improvement is about $12,000,000. This expenditure was justified in the preliminary studies by the consideration of the items mentioned in the previous article, including the reduction in grades and the elimination of pusher engines, rise and fall, curvature and distance. The new line will make possible very important operating economies as it reduces the length of line by 3.6 miles and the maximum grade eastbound from 1.23 per cent. uncompensated to 0.68 per cent. compensated, and westbound from 0.52 per cent. uncompensated to 0.237 per cent. compensated. The amount of rise and fall eliminated amounts to 327 ft., the maximum degree of curvature is reduced from 6 deg. 22 min. to 3 deg., and 2,440 deg. of central angle or about 60 deg. per mile are saved by the new line. The third track, which is provided by the reconstructed line for practically the entire distance will also be an important factor in handling the increasingly heavy traffic.

IMPROVEMENT IN GRADES.

The old line north of Scranton rises on a 1.45 per cent. grade to Clark's Summit, then descends on a 1.23 per cent. grade for six miles to La Plume. For the next 4.2 miles to the Nicholson tunnel, the grade rises at the rate of 0.53 per cent. From the tunnel it descends on a 1.23 per cent. grade for three miles to the crossing of the Tunkhannock creek, near Nicholson, and then ascends the valley of Martin's creek for 18.5 miles on a 0.4 per cent. grade to New Milford summit, from which it descends for nine miles to Hallstead on an irregular grade having 0.89 per cent. as a maximum.

This line is used by an average of 26 passenger and milk trains, 16 manifest freight and 31 slow freight trains daily. The maximum tonnage for slow trains in both directions, is 3,825 tons for the heaviest mikado locomotives, and 2,750 tons for the other engines, this tonnage being fixed by the grades on the remainder of the engine district which extends from Scranton to Elmira. On the section between Scranton and Hallstead eastbound trains with the maximum tonnage now require two pusher engines from Hallstead to New Milford, and three helpers from Nicholson to Clark's Summit. Westbound trains now require four helpers from Scranton to Clark's Summit, and one from Clark's Summit to New Milford.

The new improvements do not affect the grade between Scranton and Clark's Summit, as Scranton is located in a deep valley with rising grades on all sides, and the reduction of grade on this section would have required excessive length and curvature. From Clark's Summit north the new line descends on a 0.682 per cent. grade for 6.4 miles, and from there to the Tunkhannock creek crossing the grade is 0.2 per cent., except through the tunnel and approaches where it is reduced to 0.15 per cent. From Nicholson to New Milford summit the line ascends on a 0.237 per cent. grade and from there to Hallstead it descends on a grade of 0.61 per cent. The new and old grade lines cross a short distance on each side of the summit, the new summit being 16½ ft. lower than the present one. The maximum tonnage trains on this new grade will require only one pusher from Hallstead to New Milford, and one from the Nicholson tunnel to Clark's Summit. All pusher service will be eliminated westbound, except that between Scranton and Clark's Summit, which, as explained above, will remain the same as at present.

CHANGES IN LINE.

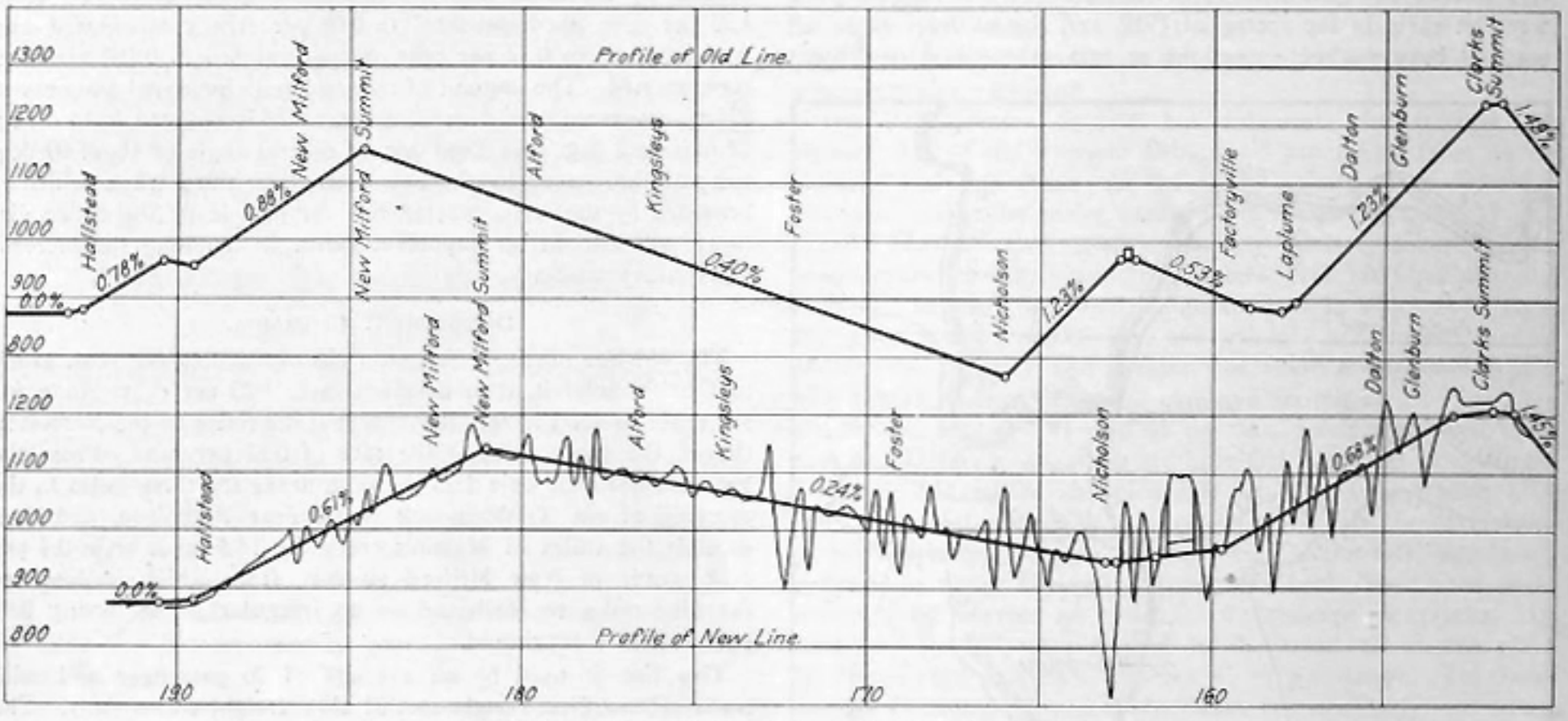
The new work begins about one mile south of Clark's Summit station, the new line crossing the old twice at a grade which is 29 ft. below the old at the Clark's Summit station. This summit cut is about two miles long and from 20 to 60 ft. deep. Near the north end of this cut the new line swings away from the

present one, reaching a maximum divergence of about 1.5 miles near Factoryville, and returning to within a few hundred feet at Nicholson. The old line between Clark's Summit and Nicholson follows the drainage, while the new line cuts across it at right angles, requiring numerous cuts and fills exceeding 100 ft. in depth. The south branch of the Tunkhannock creek is crossed on an embankment 140 ft. high, requiring 1,600,000 cu. yd. of material, and the divide between the north and south branches of this creek is passed in a double track tunnel 3,630 ft. long, with approach cuts aggregating 1,000,000 cu. yds. of excavation. The new line will be carried over Tunkhannock creek valley on a long concrete arch viaduct on which the top of rail will be 240 ft. above the bed of the stream. Between Nicholson and Kingsley the new line lies high up on the east slope of Martin's creek valley, and is nowhere more than a few hundred feet from the present tracks which are on the same side of the valley. Near Kingsley the new line crosses the present tracks and the stream on a concrete arch bridge similar to the Tunkhannock structure. The top of rail on this bridge is 150 ft. above the bed of the stream and 88 ft. above the old tracks. The Martin's creek valley is very narrow with steep and irregular slopes, requiring heavy work to keep within the standard of curvature, which is 2 deg. wherever possible, with a maximum of 3 deg. in three instances. From New Milford to Hallstead the work is much lighter, the improvement ending about two miles north of the Hallstead station.

CONTRACTORS AND GENERAL METHODS.

For construction purposes the work is divided into ten sections which are being handled by the following contractors:

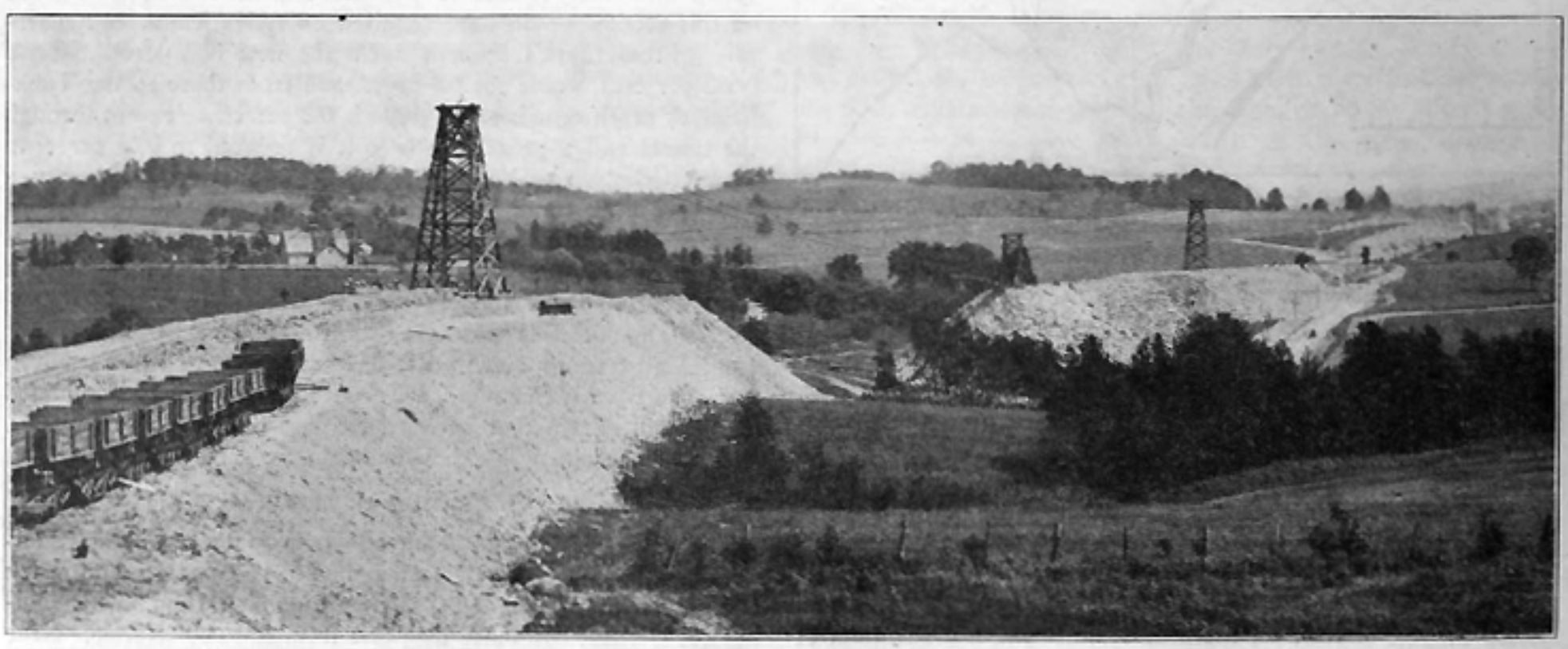
Section 1—Robert Grace Contracting Co.
Sections 2 and 3—Reiter, Curtis & Hill.
Section 4—D. W. Flickwir.



Profile of Old and New Lines North of Scranton.

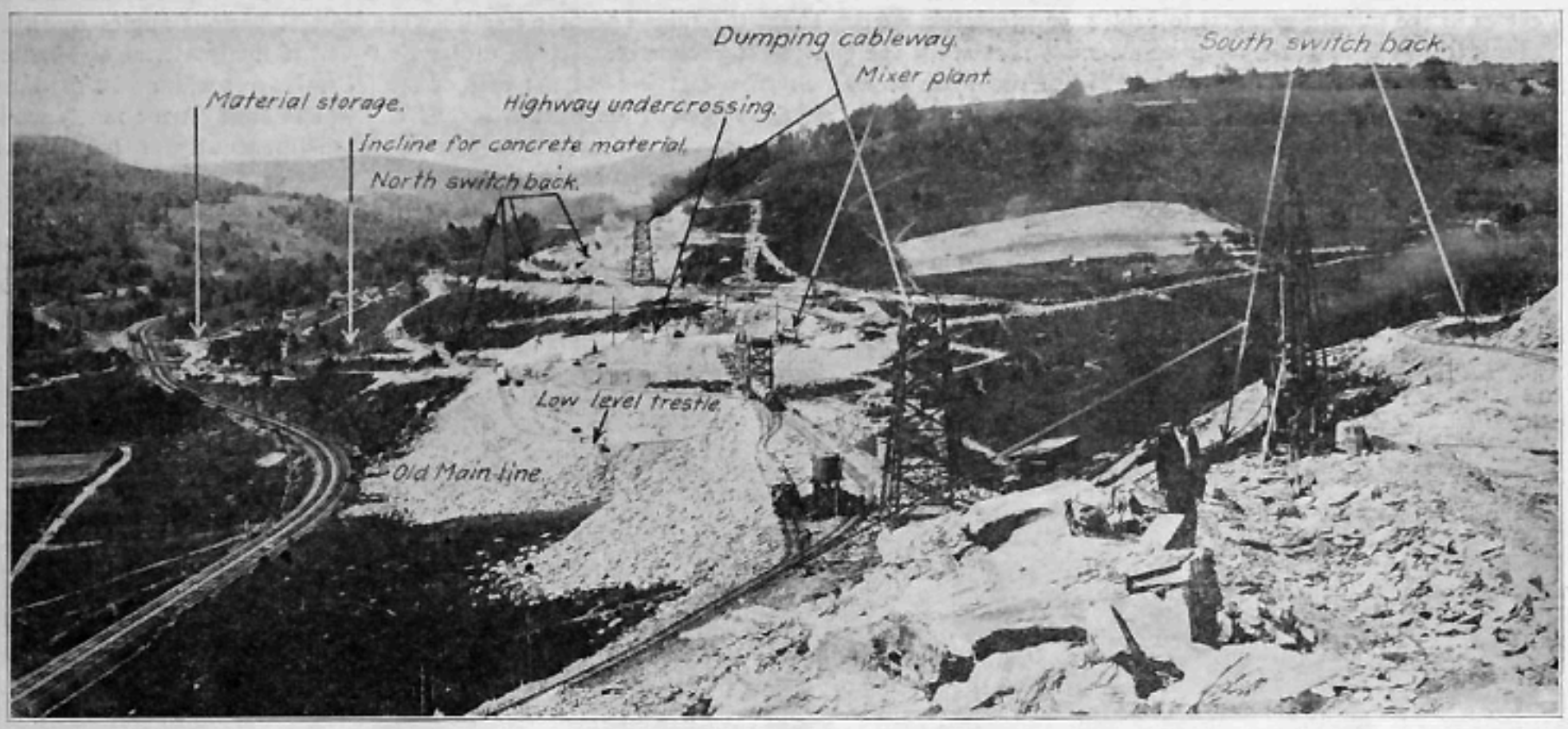
Part of Section 5—Flickwir & Bush, Inc.
Part of Sections 5 and 6—Waltz & Reece Construction Co.
Part of Section 6—James A. Hart Co.
Section 7—Timothy Burke.
Section 8—F. M. Talbot Co.
Section 9—P. McManus.
Section 10—W. H. Gahagan.

On account of the unusual proportions of all of this work only the heaviest and most improved machinery is employed in its prosecution. The contractors are using 30 steam shovels in making the excavation. Three dumping cableways have been



Ackerly Fill, Showing Clark's Summit Cut in Distance.

built for making high fills, and in at least two cases an unusual method of handling loaded cars from a cut down to the lower level of a high fill has been introduced. One of the most striking features of this work is the use of steam shovels for excavating masonry foundations, in lowering highways for undergrade crossings and other comparatively small jobs ordinarily handled by teams. One contractor who used a 30-ton Thew shovel with a ½-yd. bucket for road and foundation excavation found that it worked very economically, especially in consideration of the high rate paid to labor on this work. As has been mentioned, deep cuts and high fills are very common, there being three cuts over 100 ft. deep and five fills over 100 ft. high. There are six cuts and eight fills with a yardage of over 500,000 yds. each.



Looking North Over Riker Fill, Showing the Two Methods of Placing the Embankment, also the Concrete Plant for Building the Highway Arch.

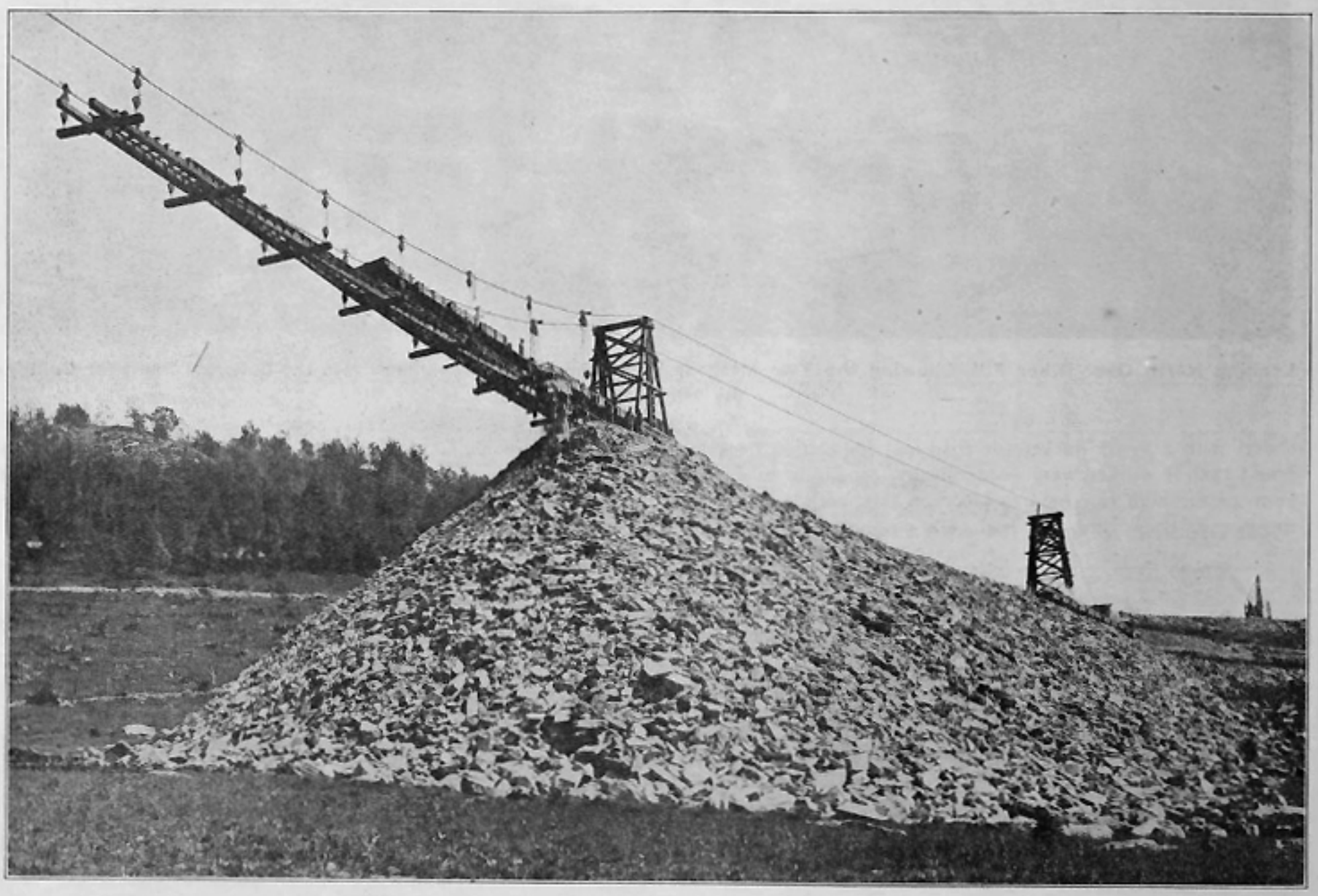
THE ACKERLY FILL.

It is only necessary to describe a few of the more important cuts and fills to indicate the magnitude of the work and the methods used in handling it. The Ackerly fill, which is located on the first section, contains 830,000 yds., and has a maximum height of 115 ft. On account of the extreme height the contractors used a dumping cableway for making this fill, intro-

Slayton Cut and Switchback to Fill in Foreground.

ducing an added advantage by dumping at both ends. This cableway had a maximum length of 2,200 ft. between anchors which length in itself is very unusual.

Instead of moving forward one end tower as the fill progressed, a third movable tower was used and the main towers allowed to remain fixed. The movable tower was kept close to the end of the fill to support the cable close to the dumping point. The cars were backed out on a track suspended from the two cables in the same manner as in cableways previously used. The dumping was carried on for a considerable time from one end in the usual manner, but in order to hasten the work it was decided to dump from both ends. When this method was first tried some difficulty was occasioned by the slack in the cable between the movable and the main towers. When a train of ten loaded cars was run out on the cableway this slack would all be pulled over the tower, and the weight of the cable itself would cause the slack to run back when the weight of the train was removed. By cutting the train and dumping five cars at a time it was possible to work at both ends by alternating so that the weight of both trains would never be on the cable at the same time. In order to eliminate this difficulty the cable back of the movable tower was finally anchored by short cables to dead men, allowing trains of ten cars to be dumped at either end, although at the time the accompanying illustration of this cableway was made, cars were only being dumped on one end. This fill is on a 2 deg. curve, which is shaped in widening. It will be made wide enough for four tracks in order to use the material from the long cut through Clark's Summit, which contains 1,450,000 yds. The old line opposite this fill included a 5 deg. curve with 180 deg. of central angle, the lack of compensation for curvature increasing the grade at this point to about 0.75 per cent.



One End of Cableway at Riker Fill, Showing Movable Intermediate Tower.

THE SMITH FILL.

The Smith fill, having a maximum height of 120 ft. and containing 540,000 yds. of material, was made in two stages by trestling. An unusual method had to be adopted here to handle the material while the roadway arch under the deepest point of the fill was being constructed. A large part of the material had to be taken out of the Slayton cut north of the fill and carried over the uncompleted arch to make the south end of the fill. The first trestles were built at various angles south of the concrete arch to utilize as much of this material as possible in carrying out the base of the fill to its full width. In the later stages of the work a second trestle was built on the newly made fill and dumping was carried on simultaneously on both levels. In order to get the narrow gage dump cars across the gap in the fill, which had to be left open for highway traffic, without building a temporary trestle up to the grade of the adjacent cut, these cars were dropped down a steep incline from the cut and run across a trestle which was just high enough to clear the new arch. A cable system was used on this incline by which a string of empties at the bottom was pulled up by the loads coming down. A similar system will be described in more detail for the South Branch fill. A dinky engine picked up the loaded cars at the bottom of the incline, pulled them across the trestle and back onto the new fill whereby a series of switch backs the high or low dumping trestles were reached. The situation is shown quite plainly in the two accompanying photographs.

SOUTH BRANCH FILL.

The largest fill on the line was across the south branch of Tunkhannock creek. The maximum depth of this fill is about 145 ft., and the yardage is approximately 1,600,000. On account of the extreme depth of this fill it is necessary to make the

deepest portion in three lifts, and an unusual method of placing the first lift was adopted. A large part of material comes out of the Crisman cut just north of the big fill, and in order to get this material down to the level of the first lift a balanced incline system, similar to that mentioned in the description of the Smith fill is being used. At the top of the slope from the new cut a pair of hoisting drums equipped with a friction brake are located between the narrow gage tracks leading from the point the line is benched in a side hill above the old line, which is shown to the left. The material for the fill was secured from the Shick cut adjacent on the south, and the Capwell cut on the north. The excavation was carried on in these cuts simultaneously, a cableway being used on the south end, and a long switch back leading to a low level trestle dump on the north end. A switch back also had to be used on the south end to carry the material down from the top levels of the cut to the

Smith Fill Under Construction Showing Two Heights of Trestles.

cut. These tracks are located so that cables attached to cars on the incline can be run directly to the drums. A train of loaded cars coming from the cut is pushed to the head of the incline and attached to a cable from one drum. At the same time the other cable is attached to a string of empties waiting on the fill at the bottom of the incline. The loaded cars are then allowed to run down the incline, pulling up the empties, the speed being regulated by the friction brake on the continuous axle of the two drums. As the bottom of the fill is 472 ft. wide a circular track was laid from the bottom of the incline so that the cars could be handled by a dinky to any desired part of the fill. The upper lifts of the fill will be made from trestles, one of which is shown in the accompanying photograph.

THE RIKER FILL.

The work on the Riker fill is unusual on account of the variety and number of operations which have been carried on simultaneously in prosecuting the work. This fill is 1,600 ft. long with a total yardage of 500,000. The accompanying photograph shows the method of handling this work very clearly. At this dumping cable which is at grade. These switch backs are clearly indicated in the illustration.

CUTS.

The Slayton cut, which is the deepest through cut on the line, is shown in one of the accompanying photographs. This cut contained 420,000 yds. of material, the maximum depth being 115 ft. The maximum haul of material from this cut was about one mile. Another of the deepest cuts is encountered in the side hill work in the Martin's creek valley, where a center height of

South Branch Fill, Showing Balanced Incline to Lower Lift and Upper Level Trestle.

114 ft. and a maximum height on the upper slope of 167 ft. is obtained. The yardage in this cut is 480,000. No unusual methods of excavation were adopted, as in most cases the rock which was encountered broke up very well when sufficiently heavy charges of powder were used.

NICHOLSON TUNNEL.

The double track tunnel carrying the new line through the ridge between the two branches of Tunkhannock creek is 3,630 ft. long. It is being driven from two shafts located at the third

points. These tunnel shafts were excavated 34 ft. x 54 ft., and lined with concrete 2 ft. thick, making the inside dimensions 30 ft. x 50 ft. The shafts are about 135 ft. deep, the upper 30 ft. being through earth and the remainder through rock. They will be provided with chimneys 20 ft. above the ground surface to induce ventilation in the tunnels to remove the locomotive gases.

As the tunnel cuts were not completed before the shafts were sunk headings were started in both directions from these shafts, and additional headings will be driven from the portals as soon as the cuts have been made. These headings are 7 ft. x 8 ft. in cross section and will be enlarged to the full width later. The material removed from the shaft headings was at first brought up in 2-yd. scale boxes by a derrick having a boom about 86 ft. long. Subsequently elevators were established in both shafts, the muck being transported from the headings in Koppel cars and discharged into buckets at the foot of the elevators, which in turn are dumped automatically into chutes at the top of the elevators, the chutes discharging into cars at the surface for removal to spoil banks. Electric locomotives will be used to haul the material to the shafts as soon as the headings have been driven far enough to warrant it.

The tunnel cross section is 8 ft. 5 in. from base of rail to springing line, the arch having a radius of 18 ft. 6 in., where timbering is required and 17 ft. where the material is self-supporting. The subgrade is 2 ft. below the base of rail, with a ditch 1 ft. deep on each side. Where lining is required it consists of a four-course vitrified brick arch resting on a concrete wall 2 ft. thick below the springing line, faced with one course of vitrified brick bonded to the concrete. The net section of this tunnel requires the excavation of about 30 yds. per lineal foot. Blue and red sandstone and red shale are encountered in alternating layers of various thicknesses. All of the rock is horizontally bedded.

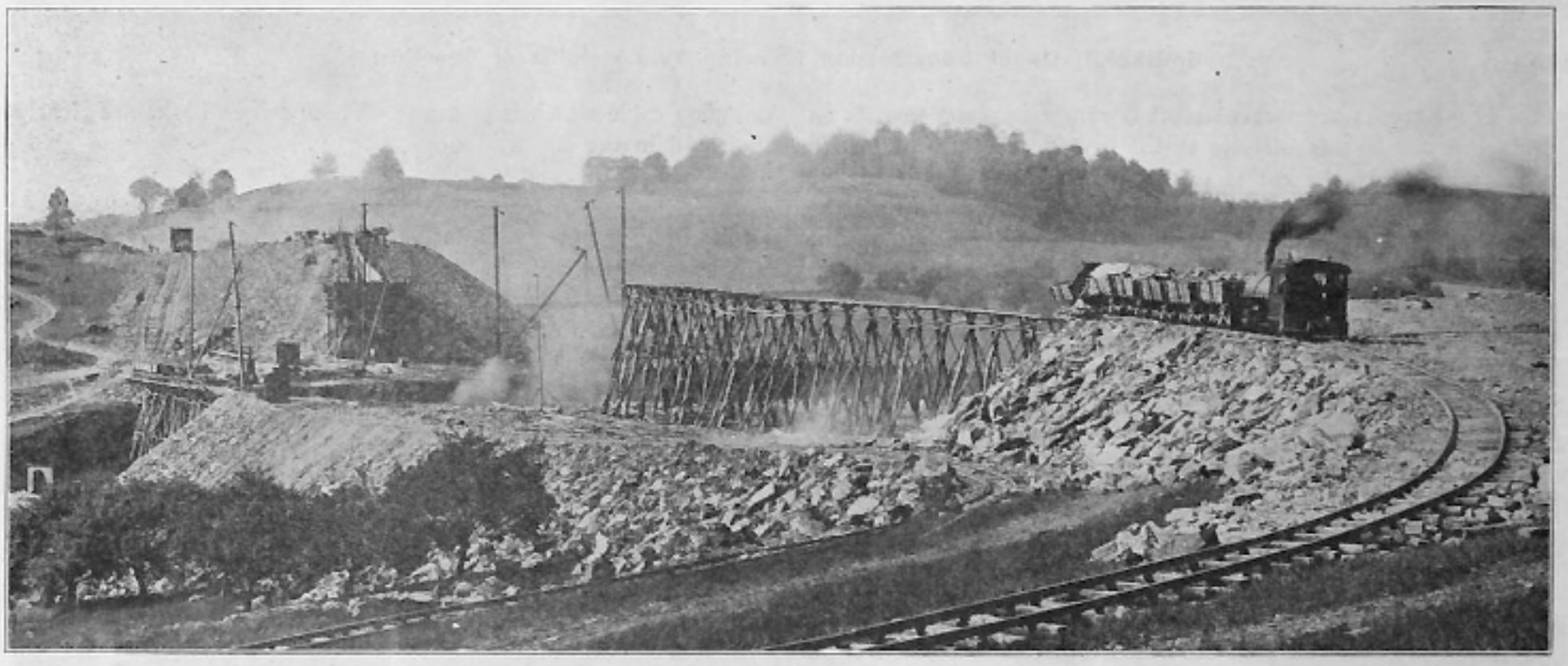
The entire work of building this cut-off was planned and is being executed by G. J. Ray, chief engineer. F. L. Wheaton is engineer of construction in immediate charge of the work.

Swiss Federal Railways.—The latest statistics of the progress of the Swiss Federal Railways during the last 10 years, 1903-12, have just been issued. They show that the railway mileage in that period has increased by 31 per cent., the receipts from passenger traffic by 49 per cent., and from freight traffic by 54 per cent. The number of passengers carried increased by 64 per cent., and the number of tons of merchandise by 46 per cent.

Private Car Trouble in England.—After the end of this year no freight cars will be allowed on the railways in Great Britain which are not fitted with spring buffers. This is in accordance with a notice issued by the Clearing House seven years ago; but it is said that the proprietors of coal mines have from 8,000 to 12,000 wagons still in use which have only "dead" buffers—those not fitted with springs. What can be done with these cars after December 31 is a question which now gives rise to some anxiety.

New Bulgarian Railway.—Now that peace has been declared between Turkey and Bulgaria, the first consideration of the Bulgarian government will be the construction of a national railway linking up Old Bulgaria with the Ægean sea, through Bulgarian territory, as the old line to Dedeagatch traverses Turkey. A recent cabinet council, presided over by the king, decided in principle on the construction of the line. It will start from a station on the Philipopolis-Adrianople line, will pass through Haskovo and Kirdjali, and terminate at Porto Lagos. According to official estimates, the construction of this line, to be 108 miles long, will cost $5,000,000, and will require three or four years to build, owing to the engineering difficulties to be overcome.

The Argentine Amalgamation.—The main reason for the sudden withdrawal of the bill for amalgamating the Buenos Ayres Great Southern and the Buenos Ayres Western railways was due to the competitive policy of the Buenos Ayres Provincial Government. That much was made clear in the exhaustive speeches on the subject which the chairmen of the two companies delivered to their respective shareholders at the ordinary general meeting. The decision of the provincial government to introduce a bill in the legislative chamber to empower them to construct a net work of 8,000 miles of lines in connection with the narrow gage railway they have been engaged in building for several years past from La Plata to the western boundary of the province came, as Mr. Simson expressed it, like a bolt from the blue. The idea of the provincial government was to cross and recross the two companies' existing lines with the object of controlling them and preventing their obtaining a monopoly and abusing their position by charging prohibitive tariffs, although the Mitre law amply provides against any such contingency. In the circumstances, the directors' decision to withdraw the amalgamation bill is not to be wondered at. Mr. Simson, however, takes a hopeful view of the situation, and is convinced that the sense of justice and fair play which characterizes the majority of the Argentines will ultimately prevail and that the province of Buenos Ayres will not give effect to its proposals.



Smith Fill, Showing Balanced Incline and Second Level Dumping Trestle.