to 16 ft. 5 in. and the center pins given some little side play. The frames, which in the first design partially covered the springs, have been rebuilt so that the springs are in plain view and can be easily inspected. Equalizers have also been introduced in the spring arrangement to evenly distribute the weight on all the wheels. These changes have proved entirely satisfactory, the cars running on the new tracks at the highest speeds as smoothly as they formerly did at speeds from 80 to 85 m.p.h.

The collection of current at these speeds has given but little trouble. At first when a speed of 110 m.p.h. was reached, violent vibrations were set up in the trolley wires and the poles supporting them, so that short circuits and breakages were caused. This trouble was overcome by using lighter collectors and better springs and by some slight adjustments of the overhead conductors.

Information for this description was obtained chiefly from a report by Consul General Mason at Berlin, and from an article in *Zentralblatt der Bauverwaltung* for Oct. 7.

Power-Operated Distant Signals.*

This committee, consisting of Messrs. Shaver (chairman), Elliott, Pflasterer, Peabody and Goodman, held a meeting at Chicago, April 7. In the opinion of the committee a distant signal at an interlocking plant cannot be worked automatically with success, and therefore they consider the question before them to be, "When, under various conditions, should distant signals at interlocking plants be mechanically operated, and when power operated?" A list of questions was sent out, and replies were received from 28 railroads. These questions were as below, and the replies are shown in the table following:

(1) Do you approve of power operated Distant Signals?

(2) Do you propose using power operated Distant Signals in future installations?

(3) Have recent new installations of interlocking plants on your road been provided with power operated Distant Signals?

(4) (a) How many power operated Distant Signals have you in use? (b) If any, at what distance are they located from Home Signal? (c) From tower?

Answers to Questions.

Railroad.	1	2	3	4 A	4 B Max., ft.	4 B Min., ft.	4 C Max., ft.	4 C Min., ft.
Boston & Albany	Yes	Yes	No	None	...	...	...	...
Canadian Pacific	..	..	No	None	...	...	...	...
Chicago & Alton	Yes	Yes[1]	No[2]	None	...	...	...	...
Chicago & E. I.	Yes	Yes	No[2]	None	...	...	...	...
Chicago, B. & Q.	Yes[1]	Yes[1]	No	None	...	...	...	...
Cleveland, C., C. & St. L.	Yes[1]	Yes[1]	No[2]	None	...	...	...	...
Chicago G. W.	No	No	..	2	...	...	...	...
Cincinnati, H. & D.	Yes[1]	Yes[1]	No	None	...	...	...	...
Chicago & N. W.	Yes	Yes	Yes[2]	8	1500	1200	2000	1700
Chicago, St. P., M. & O.	Yes	Yes	Yes	3	3000	1200	3400	1500
Chicago, Mil. & St. P.	Yes	Yes	Yes	9	3200	600	4100	900
Cincinnati, N. O. & T. P.	Yes	Yes	Yes	2	2775	2500	3375	2200
Delaware, L. & W[3]	Yes	Yes	Yes	45	2000	...	2250	...
Erie	Yes[1]	Yes[1]	Yes	4	4850	1500	5000	2600
Illinois Central	Yes	Yes	No[2]	None	...	...	...	...
Lake Shore & M. S.	Yes	Yes	Yes	4	2561	1450	3084	2494
Lehigh Valley	Yes	Yes	Yes	Not given	2500	2000	...	...
Long Island	Yes	Yes	..	18	3200	1700	2700	1500
Michigan Central	Yes	Yes[1]	Yes[1]	20	3000	2500	3500	3000
New York, N. H. & H.	Yes	..	No	None	...	...	...	...
New York Cent. & H. R.	Yes	Yes	Yes[2]	....	...	...	...	...
Northern Pacific	..	..	No	None	...	...	...	...
Pennsylvania[4]	Yes	Yes	Yes[2]	8	2500		3500	
Penna. Lines West	Yes	Yes	Yes	25	6000	1500	6000	1500
Pittsburg & L. E.	Yes	Yes	Yes	6	1600	1600	3000	2000
Southern Pacific	Yes[1]	Yes[1]	No[2]	None	...	...	...	...
Union Pacific	Yes	Yes	No[2]	None	...	...	...	...
Vandalia Line	Yes	Yes	No[2]	None	...	...	...	...

[1] In some cases. [2] Some installations planned or contracted for are to have power operated distant signals. [3] Approximate distances. [4] Average distances.

Twenty-five roads look with favor on the power operated distant signal. Only one road has had an unfavorable experience and prefers mechanical signals. Seventeen roads expect to use power operated distant signals; one road declares the usefulness of the distant signal to be still an open question, and one, on which there is a mechanical distant signal 3,840 ft. from the tower, seems to regard mechanical signals as satisfactory; the question of power operated distant signals has not been considered.

The committee, instead of going into a discussion of points which have already been considered by the club, refers to the paper by Mr. Elliott and the letter by Mr. E. M. Herr, which were read at the last annual meeting, and are printed in the Proceedings, pages 76 and 85. In conclusion, the report says:

A distant signal should be so placed that the fastest train to be controlled can be stopped easily, under the worst conditions, between it and the home signal. To fulfil these conditions safely and successfully where high speed is maintained, the power operated distant signal must be used. Where trains run at low speeds, the distant signal may be placed nearer to the home signal, but even in such cases this committee does not recommend that the signals be mechanically operated unless it be by a pipe line properly installed.

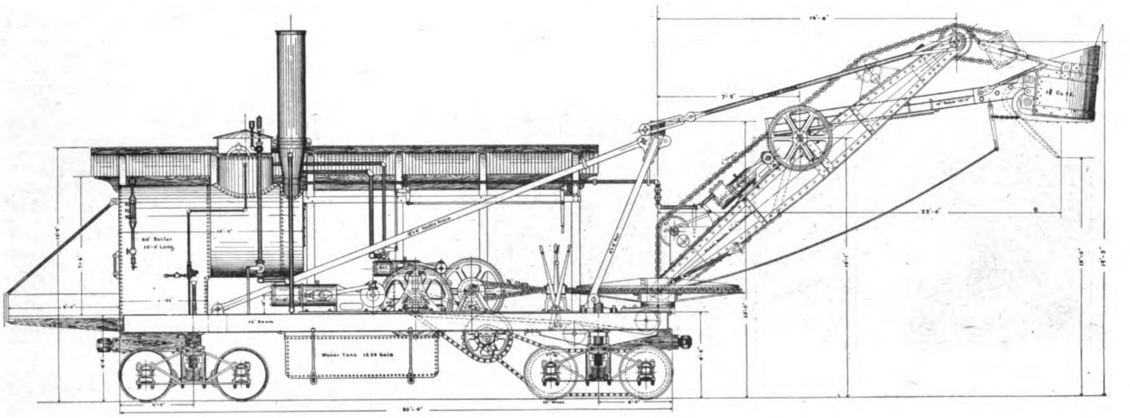
*Railway Signaling Club; Committee Report, Detroit meeting, Nov. 10.

45-Ton Boom Steam Shovel.

The Ohio Steam Shovel Company, Toledo, Ohio, has recently built a new all-metal steam shovel, a sectional elevation of which is shown herewith. It is especially adapted for railroad use in grading and filling, cutting down embankments, making heavy cuts and loading sand, gravel, broken stone, etc. It is claimed that the shovel will handle ordinary material at the rate of 1,500 to 2,000 cu. yds, in 10 hours. The dipper will dig a through cut 48 ft. wide, and has a clear lift of 14 ft. above the ground with the dipper door open. The dipper will cut 19 ft. high in a bank and 9 ft. down grade and load on flat cars. It will swing and dump five times a minute.

The boom is made of ¼-in. steel plate and 5-in. x 5-in. angles, 21 ft. long. The boiler is 60 in. in diameter and 10 ft. long and contains 130 2-in. tubes 4 ft. 4 in. long. The fire-box is horizontal, 48 in. long, 50 in. wide and 66 in. high inside. The boiler has 400 sq. ft. of heating surface and 16 sq. ft. grate area and is designed to carry a working pressure of 110 lbs. The hoisting engine is 40 h.p., with 9-in. x 12-in. double cylinders. The swinging engine is 15 h.p., with 6-in. x 7-in. cylinders. The thrusting engine on the boom is 12 h.p., with 6-in. x 7-in. double cylinders. The water tank is hung under the car and holds 1,250 gallons—sufficient to run the shovel half a day. The tank is fitted with a steam pipe injector for heating the water.

The car is 30 ft. long and 9 ft. wide and has four 12-in. I-beam longitudinal sills. The sill beams are supported by a heavy steel I-beam bolster truss, girted across the car and fitted with steel plates extending on both sides of the bolster with flanges riveted to the sill beams. The outer ends of the plates abut channel cross-girts to which they are riveted. This construction braces the overhang and prevents the front end of the car from sagging. The front end of the car is covered with ⅜-in. steel plate, 9 ft. wide, extending back 5 ft. The car is fitted with Tower couplers. The jack arms are steel and will swing back alongside the car or can be taken off rapidly. The dipper has a capacity of 1¾ yds. and is oval in shape. The propelling rig consists of steel sprocket wheels and chain, geared 11 to 1, with a chain to both axles of the front truck which sustains two-thirds the entire weight of the shovel. The car will climb a 10 per cent. grade.



45-Ton Boom Steam Shovel Built By the Ohio Steam Shovel Company.

Concrete Masonry on the Lu-Han Railway.

In his description of the construction of the Lu-Han Railway (China), given in a paper before the Institution of Civil Engineers of Great Britain, Mr. Thomas J. Bourne, who was Resident Engineer for the work, includes some interesting notes on concrete masonry and concrete. Referring to the former, he says: The limestone of the available quarry was so cut up with cleavage-planes that it would furnish no stones suitable for ashlar or block-in-course masonry. The only stone available for copings, etc., was granite, which was costly to quarry, and had, moreover, to be carted to the head of the branch line. It was, therefore, out of the question for ordinary masonry, while, on the other hand, limestone, when broken down, made an excellent and cheap aggregate for concrete. The bricks of the country are wholly unsuitable for bridges and culverts.

The stone for concrete was broken by hand, so that an average piece would pass through a 2-in. ring. The proportion of spalls being small and the percentage of voids in such stone being too great to give an economical concrete, the larger stones were picked out, or small rubble was used, being broken down to pass through a ½-in. sieve; this was done at a piece-work rate. In gaging the concrete a proportion of this fine stuff was added, displacing so much mortar in the voids of the larger stones and giving a greater bulk of concrete for the same amount of cement and the same strength of mortar, besides a more homogeneous and freer mixture, with less chance of voids in the finished work and greater capacity for consolidation under the rammer and for taking the form of the mould. A mixture composed of 1 of cement to 4 of sand and 8 of broken stone, with 1 of ½-in. chips, is for convenience described as 1—4—(8+1), and this gaging was used for box-culverts, U-shaped abutments, and abutments of arches. Piers were made of 1—3½—(7+1) concrete, and arch-rings and foundation-blocks over piles of 1—3—(6+1) concrete. In every case a layer, 1 foot in thickness, of 1—2—(3+1) concrete was laid under the bed-plates of girders. The consumption of cement for the 90 miles of line was some 44,000 barrels, most of this being of German manufacture, "Alsen" brand, packed in iron drums with wooden ends. All concrete work was kept wet for 6 to 10 days by pouring and sprinkling water over it. In the 21-ft. piers at Liu Li Ho, three holes, each 6 in. in diameter, were carried up on the center line of the piers from the top of the plinth to bedstone level, and were kept filled with water for about the same time to insure the work thoroughly setting, being afterwards plugged.

The question of wet versus dry mixing of concrete is mainly an academic one. Whatever the relative value under laboratory tests of a "driest possible" and a wet mixture may be—and this is sufficiently clear from tension tests of both neat cement and mixtures—in actual work, where concrete must be rapidly mixed by hand and placed in large quantities, there is practically no great variation possible in the amount of water used. Enough must be used to make the labor required in turning moderate, to make the mixture thoroughly plastic, and to insure the mortar getting in freely between the stones under the rammer or shovel; but so much must not be used that water and slurry collect on top of the work, or that the fluid mortar carries the cement away through spaces in the shuttering, etc. These conditions practically fix an exact proportion of water. Again, in laboratory work the briquette is always given opportunity to absorb water for setting, whereas in massive construction above water-level only the surface layers can be expected to receive more water than is given in the original mixing.

Most of the concrete work was done in hot weather, and set rapidly in consequence, and no extended ramming was possible. Plums of rough limestone-rubble were used where the structure was not subject to direct or considerable transverse stress. They were employed in abutments and piers, but not in foundation-blocks or footing-courses, and were placed so as never to be nearer to the face or to

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