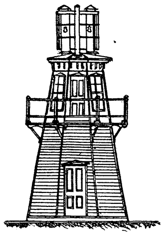


Fig. 1.

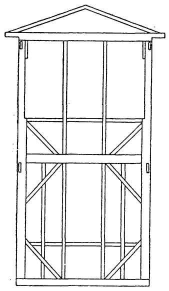


Fig. 5.

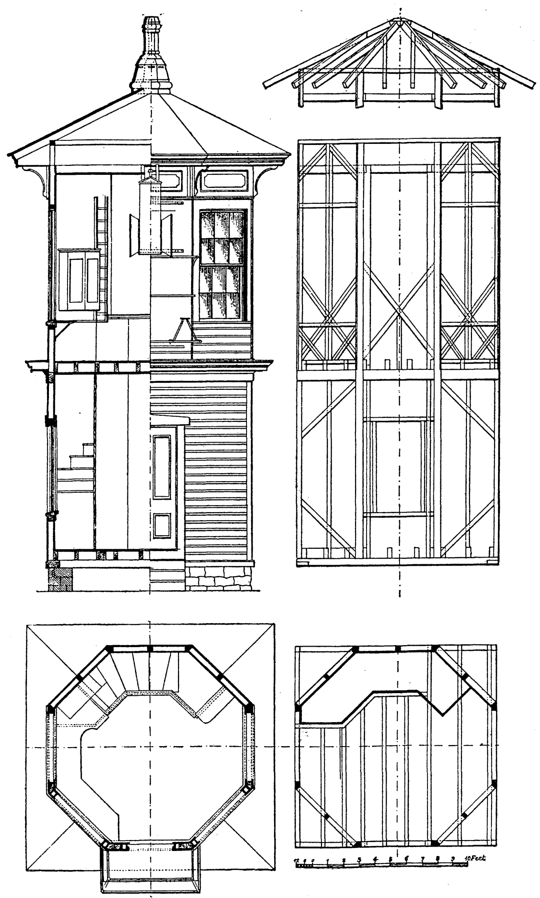


Fig. 3.

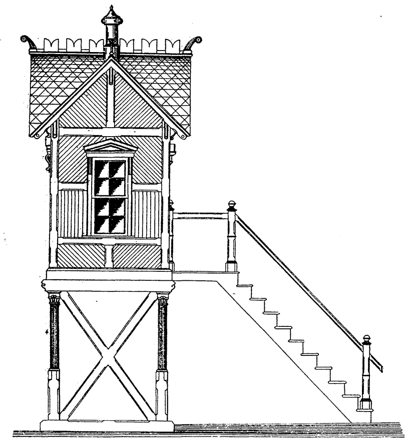


Fig. 2.

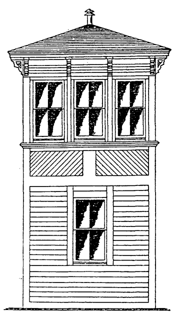


Fig. 6.

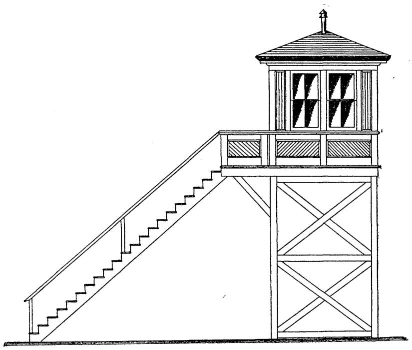


Fig. 4.

STANDARD SIGNAL TOWERS.

workmanship. Messrs. Stevens & Sons, of London, use much the same style of oil box. In fact, I believe they claim to have invented it. They also use a reflector in some cases to intensify the light.

It is scarcely possible to furnish a thoroughly efficient signal lamp at present prices unless the signal companies are able to sell something for nothing. The remedy seems to rest with the railroad officers.

Buildings and Structures of American Railroads.*

No. 7.—SIGNAL TOWERS.

BY WALTER G. BERG.

There are two classes of signal towers, namely, those intended to protect exposed points on the line and those forming part of a block signaling system. The former are, as a rule, simply watchman's houses set on trestles. The second class, namely, block station signal towers, form part of a more or less extensive signaling system by which the road is divided into sections or "blocks" of a length dependent on the varying conditions and necessities of the traffic.

Where there is an interlocking switch system or switches worked by levers from a distance, it is customary, if feasible, to locate the working levers in the signal room of a signal tower, so that one man can control the switches and the movement of trains. Signal towers with switch levers are usually to be found at terminal yards, stations, junction points and crossover systems.

Most railroads have block signals at their regular stations or stopping places, even where the regular block system is not employed between stations, in which case the regular operator at the station performs the duties of signalman. Station buildings, in which the operator is located in a small tower or extended gable front above the ground floor, have been quite extensively introduced, enabling the operator to obtain a better view of the road and lessening the possibility of being interrupted by passengers or others. This combination of signal tower and station building is advisable, however, only where, in addition to the station agent and other help, a special operator is employed. Where one or two men are required to perform all the duties connected with the station and the signaling apparatus, it is objectionable to have part of the work located in the upper story.

Descriptions and plans of a number of signal towers are presented below as illustrative of the different types in actual use.

Octagonal Signal Tower, Philadelphia & Reading Railroad.—The octagonal signal tower, shown in fig. 1, represents a style of signal tower much in use on the Philadelphia & Reading at dangerous places or where the view is obstructed. This form of tower is in reality an elevated watchman's house, the signals being under the control of a special watchman or signalman. These towers are sometimes connected with neighboring towers by wires, as for instance at tunnels, in which case they become in a certain sense block signal stations. As a rule, however, they are too small for the modern block signal system, which requires more space in the tower than offered in the design under discussion, especially when connected with interlocking switch systems.

These signal towers are frame structures, from 30 ft. to 50 ft. high, and built in the shape of an octagonal pyramid, thus giving much stability against wind and side pressures of any kind. The entrance is on the ground floor, and a ladder inside the building leads up to the watchman's room. The signaling apparatus, shown on top of the tower, consists of two vanes, each vane having three faces and each face being painted a different color, signifying, respectively, danger, caution and safety. The vanes are illuminated at night by lanterns, which are lighted in the room below and hoisted into place by pulleys. The vanes are separated by a black board, against which the lights and colors are clearly seen, and are turned by levers, working upon round tables in the watchman's room, upon which are painted colors corresponding with the colors of the vanes, so that the lever being locked upon any color on the table, the same color upon the vane is known to be facing the approaching train.

Elevated Gate House, Lehigh Valley Railroad.—The gate house of the Lehigh Valley Railroad at Whitehaven, Pa., designed by W. F. Pascoe, Superintendent of Bridges, L. V. R. R., shown in fig. 2, is a good type of an elevated gate tender's house at important grade crossings, where a system of gates is in use and the clear view from the level of the railroad is liable to be obstructed. The design presented is rather elaborate for use at an open country road or turnpike crossing outside of settlements, but it is well adapted for crossings in towns and at important thoroughfares where the neat appearance of all railroad structures is considered desirable.

The building is a frame structure, 7 ft. square on the outside, set on trestles, the floor of the building about 10 ft. above the track rail. The height of frame is 8 ft. from the sill to the plate. The sides of the building are sheathed on the outside and inside with narrow tongued and grooved boards; the roof is covered with tin or slate, laid on 1-in. boards.

The principal timbers used are as follows: Sills, 4 in. × 6 in.; plates, 2 in. × 4 in.; corner studs, 4 in. × 4 in.; door and window studs, 3 in. × 4 in.; rafters, 3 in. × 4 in.; floor joists, 3 in. × 6 in., spaced 18 in.; windows, double sash, each sash four lights, 10 × 12; door, 2 ft. 9 in. × 6 ft 4 in.; trestle legs, 8 in. × 8 in.; trestle X-bracing, 6 in. × 6 in.; trestle sills and caps, 10 in. × 10 in.

Standard Signal Tower, Pennsylvania Railroad.—The Standard block station signal tower of the Pennsylvania Railroad, shown in fig. 3, is a two-story frame structure, the lower part being square and the upper part octagonal in shape. The lower story is about 12 ft. square and about 15 ft. high, and is used for keeping sundry signal and road supplies. Steps inside the tower lead to the upper floor or the signal room, in which the operator or signal man is stationed, surrounded by the necessary signaling and telegraphic apparatus. The general design of this tower is very ornamental and attractive, while the details are carefully arranged to secure the best results in all respects without prejudice to economy. A large part of the structure is usually framed and put together in the shop before being shipped to the site.

Where an extensive and complicated switch system is connected with a block station, the space offered by the building under discussion is too small for the accommodation of the switch levers, and another standard is used, namely, an oblong, two-story frame building, the length of which is varied to suit the requirements of each case. The general features and style of the two standards are otherwise similar.

The kinds of signals controlled by the signal man are numerous.

Signal Towers, Lehigh Valley Railroad.—The signal tower of the Lehigh Valley Railroad at Jutland, N. J., shown in fig. 4, designed by C. Rosenberg, Master Carpenter, L. V. R. R., is used at the grade crossing of an important county road, where the view of the railroad from the level of the road is obstructed, making it necessary to station the gate tender or signal man at some height above the ground so as to see approaching trains.

The house proper is a small frame watch box of the usual style, 8 ft. × 8 ft. outside dimensions, height of frame about 8 ft., with large windows on all sides. This building is placed on a trestle about 14 ft. above the track, with steps leading up to the house. The trestle is built of the following timbers: Posts, 6 in. × 8 in.; horizontal ties, 6 in. × 8 in.; X-bracing, 6 in. × 6 in.

The signal tower of the Lehigh Valley Railroad at Hillsboro, N. J., shown in figs. 5 and 6, also designed by Mr. Rosenberg, is a two-story frame tower structure, 10 ft. × 10 ft. outside dimensions and 19 ft. high from ground to eaves. The first story is 9 ft. high in the clear, the second one 8 ft. 9 in. high in the clear. Steps on the outside of the building lead to the upper story, which is used for the signal man and the signaling apparatus. The lower story has three windows and a door, and is used for storing various supplies.

The principal timbers used are: Sills, 6 in. × 8 in.; interties, 4 in. × 8 in.; plates, 4 in × 8 in.; corner posts, 4 4 in. × 8 in.; studs, 3 in. × 4 in.; angle braces, 3 in. × 4 in.; rafters, 3 in. × 4 in. The inside is lined with tongued and grooved boards; the outside is covered with bevel siding; the roof consists of tin on 1-in. boards; the windows in the upper story have 13 in. × 34 in. lights, and those of the lower story 13 in. × 26 in. lights.

The signal tower of the Lehigh Valley Railroad at Jersey City, N. J., also designed by Mr. Rosenberg, shown in figs. 7 and 8, is a two-story frame tower structure, 12 ft. × 29 ft. outside dimensions and 21 ft. high from ground to eaves.

This tower is located at the centre of a large terminal yard, and the upper story serves for signaling purposes and as an office for the yardmaster and his clerks. The elevation admits of an unobstructed view over the entire yard system, thus assisting materially in keeping track of the general movement of the cars and the trains in the yard. The ground floor is divided into two rooms, one for trainmen and yardmen to occupy when not engaged in actual work around the yard, and the other for use as a lamp, oil and waste room, and for storage of sundry small supplies connected with the train operations.

The principal timbers used are as follows: Sills, 6 in. × 8 in.; floor joists, 3 in. × 8 in.; ceiling joists, 2 in. × 8 in.; interties, 4 in. × 6 in.; plates, 4 in. × 6 in.; corner posts, 6 in. × 8 in.; studs, 3 in. × 4 in; angle braces, 3 in. × 4 in.; rafters, 3 in. × 6 in. The inside is lined with 1-in. rough hemlock boards; the outside is covered with white pine weather boards; the roof is covered with tin on 1-in. hemlock boards. The lights of the windows in the upper story are 13 in. × 18 in., four lights per window, and those of the lower story 13 in. × 28 in., four lights per window. Stairs on the outside of the building lead to the upper story.

Signal Tower, Pennsylvania Railroad, at Newark, N. J.—The signal tower shown in fig. 9 represents a form of tower or elevated watchman's house in use on the Pennsylvania Railroad at Newark, N. J., and other places along their line where the ground space available for a tower is limited. The illustration shows the general style of the construction, the two posts or legs being 12 in. × 12 in. sticks. The door on the side toward the track is to enable the watchman to give the proper hand or flag signals to trains.

Signal Tower, Atchison, Topeka & Santa Fe Railroad, at Chicago, Ill.—In fig. 10 a perspective view is shown of a signal tower in the terminal yard of the Atchison, Topeka & Santa Fe Railroad at Chicago, Ill. This building is about 6 ft. square and rests on four posts, each 6 in. × 6 in., which are fastened to a frame work bedded in the ground. The four posts mentioned form a square, that only takes up 24 in. of ground space. Iron rungs fastened to the posts on one side of the square form a ladder leading up to the house, the entrance being through a trap door in the floor. A number of switch and signal levers are located in the house, the connecting rods down to the ground being placed inside the square formed by the posts.

Signal Tower at Jersey City, N. J., Central Railroad of New Jersey.—In fig. 11 is shown a perspective of the large signal tower of the Central Railroad of New Jersey, connected with the large interlocking switch and signal system in their terminal yard at Jersey City, N. J.

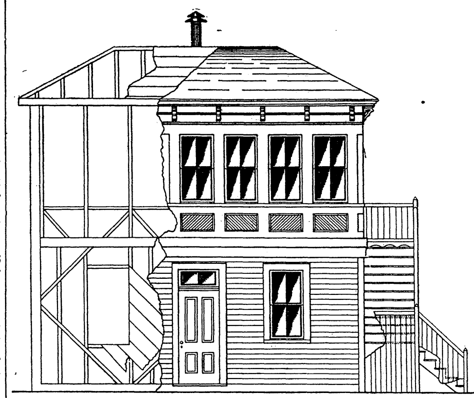


Fig. 7.

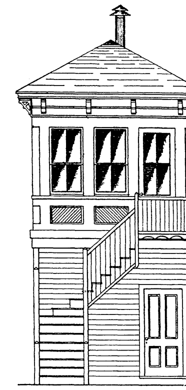


Fig. 8.

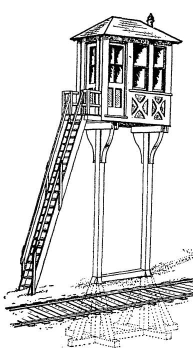


Fig. 9.

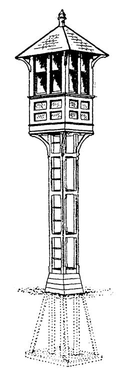


Fig. 10.

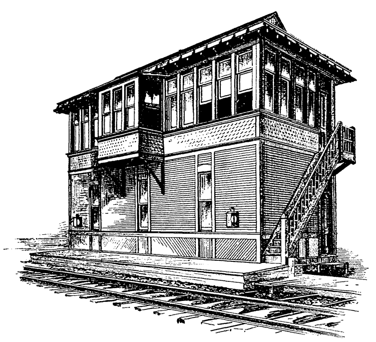


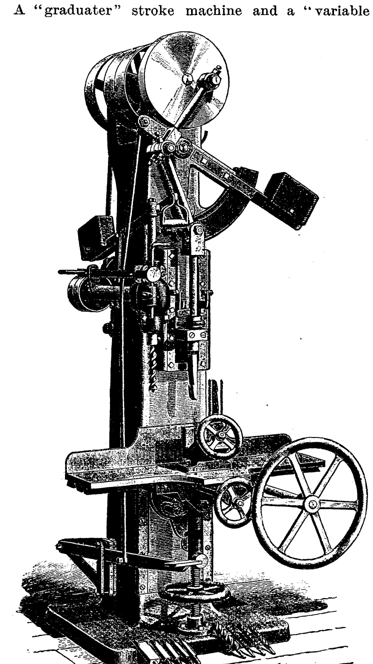
Fig. 11.

STANDARD SIGNAL TOWERS.

Graduater Stroke Mortising Machine.

The engraving on this page has been sent to us by the builders, who are well known to our readers. The machine shown belongs to a class called "graduater stroke mortising machines," which were first invented in Cincinnati, O., more than thirty years ago, and so far have never been made anywhere else since. This is a singular circumstance, but it is true, and the claim is made by the writer after a tolerably thorough acquaintance with the matter in this and various other countries.

A "graduater" stroke machine and a "variable"



Graduater Stroke Mortising Machine.

stroke machine are very different. Of the latter there have been many invented. Of the former, as said before, only two have come into general use. In a graduater stroke machine the chisel is set in motion from a still point, its stroke gradually increasing downward from that still point, and not as in a variable stroke, passing equally above and below the centre. In the first case the stroke of a machine need not be greater than from a half to one inch more than the depth of a mortise; but in the variable machine the stroke must be twice the depth of a mortise, plus the clearance. For illustration, a graduater stroke machine will cut a mortise 6 in. deep with a stroke of 7 in., and a variable stroke one will require a range of 13 in. for the same work.

As a geometrical problem this is by no means plain and has not been well understood in this country and not at all in other countries. This feature of operation was, no doubt, an accident at the beginning. A Cincinnati mechanic by the name of Guild, of the firm of Hinkle & Guild, contrived a power attachment for a foot mortising machine between 1858 and 1860. To give the chisel a reciprocating motion he placed beneath the floor a pivoted vibrating lever, and on this fixed a sliding block, to which a link from the chisel slide was attached. This block was moved on the lever by means of a treadle, and when brought to the outer end, where the crank connection was attached to the lever, the effect was the same as though the chisel bar was connected direct to the crank, giving a full stroke to the chisel, the lever having no function; but when the block was moved back to the fulcrum of the lever the motion of the chisel bar stopped, but it stopped at the top of its stroke by reason of the diagonal position of the connecting rod to the chisel bar. This machine would cut mortises nearly as deep as its stroke, and when not at work the chisel bar would stop.

This was the beginning of what has proved a great invention in wood working. The machines were improved; the lever was placed on the top and made an integral part of the machine. Messrs. Lane & Bodley, of Cincinnati, began the manufacture, and have made thousands of machines on the Guild principle.

The other graduater movement, embodied in the Egan Company's mortiser, shown in the illustration, was a later invention, made by Mr. G. V. Orton, formerly of San Francisco, Cal. The first machine was made about 1865, and while it had the movement required for the chisel bar, it communicated so much jar or shock to the treadle that workmen declined to use it on hard wood. This is overcome by various expedients, one of which, and a very complete one, appears in the present machine.

The movements of the machine are difficult to explain; it is called a triple connection, or sometimes a knuckle joint movement. When the chisel is at the top of its stroke, and still, the two lower links vibrate on the same centre at the bottom as well as the top end; but when the back link, the one next the column, has its lower fulcrum moved away from that of the one attached to the chisel bar, then the latter gradually partakes of the crank motion until the two front links form a vertical line through their centres, and the chisel has a stroke equal to that of the crank above. There are advantages in both the Guild and Orton methods, but the latter is more compact and capable of high speed.

As remarked in the commencement, it is wonderful that an invention of such importance should not have found its way into wider use in thirty years; but it must be remembered that not one in ten who use the machines understands the principle involved in their movements. The machine illustrated is an ingenious adaptation of the triple link movement, is well designed, and, what is especially essential in a mortising machine, strong and substantial. It has been designed for car works, railroad shop repair work, etc. Further information may be obtained from the builders, The Egan Company, Nos. 202 to 222 West Front Street, Cincinnati, O., U. S. A.

The Railroad System of Chile.

BY F. W. CONN.

Chile has more miles of railroad than most people suppose. I use the word system, advisedly, for she has a system, and a very good one it will be when completed; a trunk line to extend the whole length of the country, between the Cordillera de los Andes and the coast range, with feeders to the coast and the mountain valleys, and one or more lines to cross the Andes and connect with the Argentine system. This is being built and operated by the government.

There are in operation to-day over 1,000 kilometres, as much more being constructed, and the balance, as soon as an estimate can be made, will open for bids. There are quite a number of short roads owned by private corporations. These are mostly in the north of Chile and run from the coast to the nitrate beds or the copper mines. The trunk line, when completed, will connect with all these roads. In describing roads now in operation, we shall begin at the north end of Chile and go down the coast.

The first is the Arica & Tacna, reaching from the port of Arica to the town of Tacna, a distance of 63 kilometres. This road was completed in 1854. It is controlled by English capital, with its principal office in London.

Next we have the Nitrate Railway Company (Limited). This road connects the ports of Pisagua and Iquique, and runs to various nitrate deposits. It has in all 370 kilometres. To get up out of Iquique and Pisagua switchbacks are necessary. It is a fine sight from aboard ship