upright leg of the T. Round notches in the rocker to match pins in the tread prevent the former from getting out of place in operation. This method of raising and lowering the leaders is remarkably satisfactory, because with the hammer properly located in the leaders (just level with the end sills) they are so nicely balanced that with the use of very little power they can be started from either the horizontal or vertical position, and once started they will continue their motion, reaching the opposite position without jar. The rocker, instead of being a true circle, is slightly flattened, with the result that if the leaders were left to assume a normal position they would remain on an incline. Therefore, when they are started either down or up it is necessary to give them a sufficient motion so that the momentum will just carry them to their proper position. When the leaders are lowered, the hammer is drawn up until it comes opposite the platform, and is thus given support because the platform at that time has its lower edge resting on the deck.

The points of great value accomplished by this design are that the leaders are so nicely balanced that they can be raised and lowered without making any outside hitches, and when lowered they are so far back on the car that the ends do not overhang, and thus prevent coupling with box cars.

The swinging of the deck is accomplished by operating pinions which engage the circular racks attached to this intermediate deck. There is one short section of circular rack at each end of the intermediate deck, and at the center is a complete circle by which the deck can be swung clear around. So long as the ends are over this intermediate deck they are partly supported and enabled to move freely by rollers, but after swinging clear of these, the deck is balanced by the proper arrangement of the load. The pinions for swinging the deck are operated by ratchet levers.

Another railway pile-driver, of quite different construction, is shown in Fig. 10. The car framing is of oak, well trussed, and mounted on a pair of steel trucks. The turntable is on the front end of the car, and the horizontal bed of the steel leader truss projects normally 7 ft. beyond the car. This truss can be run ahead so as to drive piles 16 ft. in advance of the car, and can be swung round at right angles to the track, but it is entirely independent of the engine and boiler, which are permanently attached to the car framing. Mounted upon the truss is a hand hoist, which can be used for raising and lowering the leaders, hauling on piles to hold them upright, etc.

The leaders are pivoted to the brackets on the short posts on the end of the leader truss. In arranging the machine for transportation, the stay rods are detached from the top of the leaders and lowered to an approximately horizontal position. The leaders swing backward to a horizontal position, the head-frame resting on the cross-piece at the rear end of the truss. The lower end, below the pivot, projects in front of the truss, the beams of which, as already noted, project 7 ft. in front of the car. A flat car must therefore be coupled to the pile-driver to enable it to be coupled into a train. The machine, however, is self-propelling, and can travel at a speed of about five miles per hour, so that while working it does not require the constant service of a locomotive. In a special make of the machine, the leaders can be inclined by means of a worm gear in order to drive batter piles. The weight is about 84,000 lbs., and when arranged for transportation the extreme height is 14 ft. 6 ins.

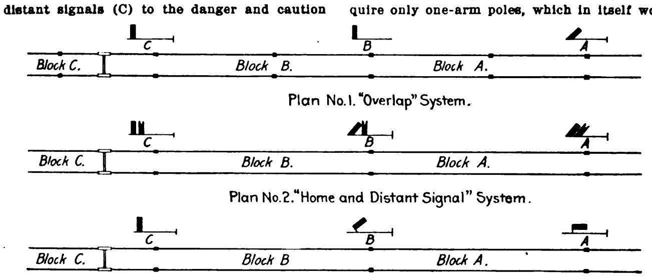
This pile-driver was built for the Gulf, Colorado & Santa Fe Ry., and is equipped with a steam pile hammer instead of the ordinary drop hammer. The usual high-speed friction hoisting engine is also fitted, so that a drop hammer can be used if desired. The steam hose to the hammer is looped up at the side of the leaders, and is attached to a pipe carried under the floor of the car and extending through the end sill. For photographs and particulars of this machine we are indebted to the builders, the Industrial Works, of Bay City, Mich.

POSSIBILITIES OF THREE-POSITION SIGNALING.*

By Frank Rhea.†

Let us first consider the possibilities of three-position signals, used to give the indications with an automatic block system. As automatic block signals are installed to-day, we are limited to two systems. The first, shown by plan No. 1, is known as the "over-lap system." The second, which is shown by plan No. 2, is the "home and distant signal system." The proposed "three-position system" is shown by plan No. 3. As is well known, the "over-lap system" is composed of home signals only, and the indications are so arranged that a train entering block (A) throws signal (A) to the danger position. The train passing into block (B) throws signal (B) to danger, and still holds signal (A) in the danger position, until the rear of the train has passed a prescribed point beyond signal (B). It then releases signal (A), allowing it to go to the clear position, but still holds signal (B) in the danger position—and so on through each block.

The "home and distant signal system" consists of a home and distant signal placed on the same mast. A train entering block (A) (plan 2) throws home and distant signal at (A) to the danger and caution positions, and when the rear of the train has passed out of block (A), home signal (A) is released and goes to the clear position, but the distant signal (A) still remains in the caution position. The train in passing into block (C) throws the home and distant signals (C) to the danger and caution positions, and when the rear of the train has passed off of block (B), home signal (B) will be released and go to the clear position, when distant signal (A) will also indicate clear.



Plan No. 1. "Overlap" System.

Plan No. 2. "Home and Distant Signal" System.

Plan No. 3. "Three-Position Semaphore" System.

The proposed system, as shown by plan No. 3, consists of one home signal for each block. The train entering block (A) throws signal (A) to the danger position. The train entering block (B) throws signal (B) to the danger position, and when the rear of the train has cleared block (A), signal (A) assumes the middle or caution position (showing a green light at night) indicating that block (A) is clear but that home signal (B) is in the danger position. The train entering block (C) throws signal (C) to the danger position, and when the rear of the train has cleared block (B), signal (B) assumes the middle or caution position (showing a green light at night) and signal (A) assumes the clear position—indicating that block (A) is clear, and that signal (B) is either in the caution or clear position. It thus gives the completeness of information that is given by the home and distant signal system, but requiring the reading of but one signal only at a time, for this completeness of information.

It is generally admitted that the principle of the over-lap system has not proved satisfactory, and that by using it you either retard your speed of trains, which limits the volume of business to be handled over your tracks, or (if you do not retard your speed) you do not derive all the benefits and safeguards which it is possible to obtain from a system of automatic signals. This is due to the fact that you do not have any caution or advance indication of the condition of the next block in advance. By this I mean that you can get a clear signal at one block, and an absolute stop signal at the next block.

The "home and distant signal system" and the "three-position system" give the same completeness of information, as they both show the condition of two blocks in advance. I think it will be readily admitted, however, that the "three-position system" gives its indications more simply and to the point, and that it is easier for the trainmen to read and interpret these indications quickly. Other things being equal, the simpler apparatus or method is always the best.

From an economical standpoint the "three-position system" has the advantage of considerably less cost in expense of installation over the "home and distant signal system;" in fact, the cost of installation is only slightly increased over that of the over-lap. From a maintaining standpoint, it is probably considerably the cheapest of the three, and from an operating standpoint, the expense should be exactly the same as the "over-lap system," with the same number of signals, and decidedly less than the "home and distant signal system." It will be appreciated where this occurs from the fact that we have but half the lamps that we do with the "home and distant signal system," and when it is considered that it costs something like $12 a year, in labor and oil, to operate one lamp.

Let us now consider the three-position signal used in connection with interlocking. It has become the generally prevailing practice to use two arms on all high, home, interlocking signals, where there is a high speed route and one or more slow speed or diverging routes; the top arm governs the high speed route, and the lower arm all the slow speed or diverging routes. The proposed arrangement of the three-position signal would govern the high speed route when the signal is in the vertical position—or shows a white light at night. When the arm is inclined 45°, or shows a green light at night, it would govern the slow speed, or diverging routes. With this method of signaling we would make a characteristic difference between the high speed route and the diverging routes, and would carry out in practice, the giving of a low speed or caution signal, when a movement is to be made at a low speed. At present the usual practice is such that, if one of the lights goes out at night, the engineman has no means of ascertaining whether he is receiving the indication for the high speed route or the low speed route, except as he may be able to remember at which heights the respective signals are located.

The three-position signal used in connection with interlocking has decided advantages in the way of economy, as has the three-position automatic system. It would require only one-arm poles, which in itself would be a considerable saving. A three-position signal, however, would have to be operated with pipe connections, but as it is the practice on a number of roads to use pipe-connected home signals, this would still effect the saving of the connections to the lower arm. This, of course, would mean proportionately fewer number of connections to be maintained, and care of the small number of lights would mean in its turn a corresponding saving.

*Condensed from a paper presented at the annual meeting of the Railway Signaling Club at Boston, Mass., Nov. 14.

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PROPOSED DESIGN FOR A STEEL AND CONCRETE DAM

By John S. Fielding, Civil Engineer.*

In the opinion of the writer, no modern dam utilizes, in its design, all the means now at hand for the building of a permanent, economical and absolutely trustworthy structure of this type Though dams are among the very earliest of engineering efforts, more uncertainty still exists as to the proper methods to be pursued in insuring stability than in the case of almost any other structure. In the case of bridges, buildings, machines, etc., engineers are almost a unit in regard to the manner of estimating their strength, efficiency and factor of safety; and with given loads and conditions of loading they can check each other's designs, and individual responsibility is largely eliminated, for each engineer feels that he is supported by the general practice in such cases. If such a condition of intelligent common practice could be brought about in regard to the construction of dams, it would be much better for the builders of such structures, and for the community that would be exposed to the effects of any failure in the judgment of the individual.

With this idea in view, the writer has attempted to find a form of construction that will give a large factor of safety under the most unfavorable conditions that can be assumed; though, it is evident at the start, that so desirable a result can, in most cases, only be obtained at some moderate increase over the cost of the older designs. Many difficulties have to be encountered in the attainment of such an end; but it is an end well worth striving for, and the following suggestions are submitted to the profession for what they are worth.

Hydrostatics, so-called, has only to do with the pressures involved in dam construction; and the resistance against these pressures is purely a matter of statics. There is no difference of opinion as to the laws of statics; but practice does differ widely as to the application of these laws in designing structures to resist hydrostatic pressures. Now, if we assume the triangle as the governing principle of statics, as applied to dams, its de-

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