

Bridges.

Considerable time and thought has been expended by bridge builders in perfecting methods for the speedy erection of iron bridges. The profits of the job and the fortunes of the promoters of the enterprise may many times depend entirely with the speed with which the iron can be put in place and self supporting, be swung clear of all obstructions. Probably nowhere else could be found a better illustration of the adage "time is money." For bridges of very small span and not very great height, a gin pole is sometimes used for the erection. It is easily moved to the different points where wanted, either by hand or with the assistance of a team. This is the simplest plan of raising iron and requires no description.

For bridges of greater height and longer span a false work must be erected and carry the iron until it is self supporting. The false work is made up of piles driven into the ground, or if there be a rock bottom the piles are set on end and well braced together and anchored to the bottom sometimes with heavy chains. The false work is brought to within a few inches of the top of the pier and on this a frame work is built which carries the upper chord, the lateral bracing, and everything in fact but the floor system. The iron is raised to position inside this frame work by block and falls fastened to it. If it is desired to provide for the passage of trains during erection this can be accomplished by filling in the space between the false work and the rails with ties, but care must be taken that these ties are so spaced as not to interfere with the placing of the floor beams. Then in placing the stringers it is very easy to put them in, one panel at a time, and not interfere with traffic. This method of raising bridges is still practiced to some extent, but has nothing in particular to recommend it, it takes a great number of men, since an engine is seldom used for raising the iron into position. A great deal of time is lost in building the frame work or skeleton for supporting the iron, and then such is not the only object which is desirable to obtain in successful bridge erection. Due regard must be paid as well to the economical use of materials. This point is also lost sight of in the above method of erection. A great deal of material is used in the frame work since each and every span requires such a skeleton.

For this reason the stationary frame work is replaced by a movable frame called a traveller. The traveller marks a very great advance in economy in bridge construction. A traveller but 33 feet long is sufficient to erect a number of bridges with spans varying in length from 100 to 200 feet.

The traveller for a through span as usually constructed consists with two or three bents with their braces. A bent is built up of two plumb posts just far enough apart to clear the iron work when it is

desired to move the traveller. Outside of the plumb posts are the two batter posts which incline from the bottom to the top thus putting the spread caused by the batter at the top instead of the bottom. This makes the traveller somewhat unstable, and it is customary to run guy ropes out from the floor corners to steady it.

The bents are capped with a long timber running clear across. At the bottom there are one or two sets of wheels depending upon the arrangement of the posts on a side. If the two posts are not separated and are framed into the same timber but one set of wheels will be necessary. If the posts are separated by a short timber, two sets of wheels will be necessary and the traveller will take up more space on the false work. Part of the wheels are usually flanged and part flat without flanges. The block and falls are fastened to the top of the traveller, and runs to a hoisting machine operated by a stationary engine, placed at some convenient point upon the false work.

The false work is the same as above described except that allowance must be made for the stringers and plank carrying the traveller track so as to bring the rail above the top of the pier. Also if it is desired to maintain traffic during erection the single cap of the false work is replaced by timbers bolted to the side of the piles, and the plumb posts are sunk up between these timbers and inside the iron stringers thus dispensing with the ties of the other method.

Care must be taken to so space the bents of the false work so as not to interfere with the driving of the pins and the placing of the floor beams, and the plumb piles must be well within the iron stringers so as to avoid cutting.

It will also be found more convenient to extend the plumb posts so that the traffic track will be elevated at least two feet above its permanent position. Then all the iron work, floor beams, stringers, ties, etc., can be put in place without tearing out any of the false work and only cutting it a little to get the floor beams in place.

The operation of erection then is as follows: The castings for the fixed and roller ends are placed in position on the pier and the lower chord is then placed in position and pinned together. The traveller is then moved to the centre panel fastened in position by hooks which grasp the track, and guys run out from the corner. The posts are then brought out on push cars, picked up by the working blocks and falls, lowered into position, pinned at the foot and held at the top by another set of falls. The top chord is then brought out and placed in the same manner, and then the braces. The connections are fastened together temporarily by bolts.

After the braces are put in, the panel is self-sustaining, except the first one erected, which will be braced temporarily by a rope or board until the traveller is moved to the next panel.

Water Waste.

Many circumstances at the present time make the consideration of the question of the sale of water by measure opportune. Foremost amongst these is the fact that the latest developments of biological research have proved that organisms injurious to the health, which chemical analysis cannot detect, may exist to a dangerous extent in water hitherto held to be above suspicion. Those who supply water to the inhabitants of cities must therefore exercise greater care in the selection of the source, in the conveyance and purification of the water, in its storage and in its final distribution to the public. This greater care in each successive stage necessarily enhances the cost of the water. The governments, moreover, of the densely populated countries of Europe are beginning to enforce the laws relating to rivers and watercourses, and to prohibit the sewage of towns being discharged into them unless previously purified. The necessity of this purification, whether by chemical treatment or by irrigation, tends to cause the municipalities after making liberal provision for the domestic and trade water supply of the citizens to deter from excess in order to keep down the quantity of sewage water and the cost of purification to a minimum. Lastly, the prevailing social conditions tend to concentrate the population in the towns which, as a rule, are distant from suitable sources of water supply. Thus the concentration of the population increasing the quantities indispensable at distant centres, the protection of the streams from pollution and the more accurate appreciation of and means of testing the hygienic conditions of the water supplied, make it important to limit the quantity to the actual requirements in the interests of the consumers on whom the cost eventually falls.

It is well known that the majority of the waterworks supply a much larger quantity than the actual requirements of the consumers, and the excess runs to waste without benefit to those whose premises it passes, and to the damage of the community. A history of these waterworks would be a record of an incessant struggle to diminish or deter from waste. Parliament has granted them almost unrestricted powers for house inspection. They can prescribe the nature, construction and qualities of the apparatus for the conveyance and delivery of the water within private property, and can exact fines for non-compliance. Nowhere in large towns have these measures and efforts done more than mitigate the evil for a short period. As soon as the efforts were relaxed, owing to the opposition of the inhabitants, the previous condition returned; and the waterworks have been compelled to expend capital for increasing the supply, knowing well that the outlay need not have been made, had it been in their power to prevent the unrestricted freedom of the consumer with reference to quantity being abused. This abuse