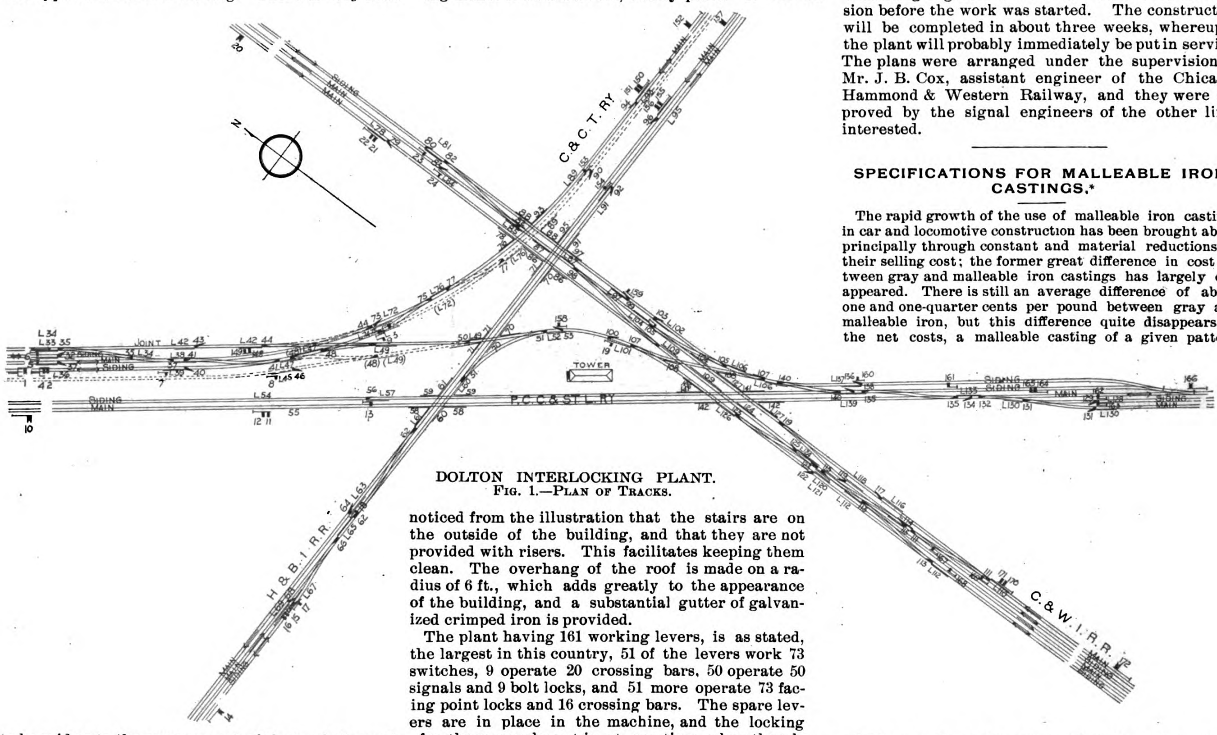
INTERLOCKING PLANT, DOLTON, ILL.

The largest mechanical interlocking plant in the United States has been under construction for several months at the crossing of the Chicago & Western Indiana Railroad with the Pittsburgh, Cincinnati, Chicago & St. Louis, the Chicago & Calumet Terminal and the Chicago, Hammond & Western Railways near Chicago. This crossing is a very important one in that it is at the point where the Chicago & Western Indiana Railroad ends and the Chicago & Eastern Illinois road begins, and connections are formed here between three belt lines. The plan view, Fig. 1, shows the arrangement of tracks, the names of the roads being designated. A crossing has existed for a number of years at this point, but the addition of the Hammond & Blue Island, which is now the Chicago, Hammond & Western, necessitated the application of interlocking. There is very little to be said as to the arrangement of the tracks beyond that, with the exception of those of the Hammond & Blue Island Railroad, they were put in at different times with entire disregard of ever being interlocked, and the cost of changing the arrangement for convenience in applying the apparatus was so great as to prohibit systematizing it. The result of this is that some of the signals are nearly 2,000 ft. from the tower and the arrangement of the work, both as far as track and interlocking is concerned, is somewhat awkward.

The tower is 22x80 ft. in size and contains 172 levers, 161 of which are connected with the outside work and eleven of them, which are numbered from 26 to 31 inclusive, and from 143 to 147 inclusive, are available for extensions of the work. The tower is the new Union Switch & Signal Co.'s standard, and its appearance is shown in Fig. 4, which was prepared from a photograph. The windows are arranged with transoms which open outwardly and form an effective means of ventilating the building from points above the heads of the operators. These transoms are hinged at their tops, and when open protect the interior of the building from the weather. Below each transom is a window with a single pane of glass, 26x48 in. in size, without obstructions to the view of the operators. Certain of these windows, though not all of them, are hung upon hinges at their sides and open outwardly. By this arrangement of windows it is seen to be impossible for the view of the tracks to become obscured by the sashes, as would be the case if the windows slid either horizontally or vertically. The lever room of the tower is sheathed, and the large area of the building makes it an attractive, roomy place. It will be noticed from the illustration that the stairs are on the outside of the building, and that they are not provided with risers. This facilitates keeping them clean. The overhang of the roof is made on a radius of 6 ft., which adds greatly to the appearance of the building, and a substantial gutter of galvanized crimped iron is provided.



DOLTON INTERLOCKING PLANT.
Fig. 1.—Plan of Tracks.

The plant having 161 working levers, is as stated, the largest in this country, 51 of the levers work 73 switches, 9 operate 20 crossing bars, 50 operate 50 signals and 9 bolt locks, and 51 more operate 73 facing point locks and 16 crossing bars. The spare levers are in place in the machine, and the locking for these may be put in at any time when they become necessary. It will be noted in Fig. 1 that the direction of traffic movement is given by the arrows, and the dotted lines along the Chicago & Calumet Terminal tracks indicate a proposed extension provided for in the machine. All possible movements have been provided for in the interlocking work and back up movements may be made on all of the tracks, dwarf signals governing such movements having been installed. There are connections between all of the roads for switching movements and the plant is to be a busy one on this account. The apparatus is the standard of the Union Switch & Signal Co. throughout with the exception of two Travis derails which were put in at switches Nos. 53 and 100 immediately in front of the tower. The ordinary point derail could not be used in these cases, owing to the fact that the combination of 21 and 15 degree curves required the use of a guard rail past both of these switches, and the sharpness of the curves would interfere with the maintenance of derail points if put on the outside rail of the curves. The Travis derail is manufactured by the National Switch & Signal Co. On the Pittsburgh, Cincinnati, Chicago & St. Louis tracks, Wharton derails were used which do not require cutting the main traffic rails. Where it is necessary for the main line of lead out to cross the tracks of the Pennsylvania or the Hammond & Blue Island roads, the tracks are carried on 12 in. timbers and upon 6 in. I-beams between which the lead out connections pass. The home signals are all wire connected and no selectors are used. Crossing bars are provided at every crossing, and it is understood that the plans for the work were approved by the consulting engineer of the state warehouse commission before the work was started. The construction will be completed in about three weeks, whereupon the plant will probably immediately be put in service. The plans were arranged under the supervision of Mr. J. B. Cox, assistant engineer of the Chicago, Hammond & Western Railway, and they were approved by the signal engineers of the other lines interested.

SPECIFICATIONS FOR MALLEABLE IRON CASTINGS.*

The rapid growth of the use of malleable iron castings in car and locomotive construction has been brought about principally through constant and material reductions in their selling cost; the former great difference in cost between gray and malleable iron castings has largely disappeared. There is still an average difference of about one and one-quarter cents per pound between gray and malleable iron, but this difference quite disappears in the net costs, a malleable casting of a given pattern weighing sometimes sixty per cent less than the corresponding gray iron casting. This great slump in malleable iron prices has benefitted the purchasers at the expense of the manufacturers. It is true that increased and improved facilities have cheapened the cost of production, and the stronger companies have been able to buy raw materials at lower prices. But there is a danger now that purchasers will be made to suffer unless they protect themselves by rigid requirements as to quality.

Malleable iron foundries are multiplying rapidly, and while the demand for this material is increasing, the capacity to supply is undoubtedly growing faster than the demand. In the hot competition now existing, purchasers are getting the benefit of constantly lowering prices. This, as has been said, is well enough while it is not accompanied

*From a paper by C. L. Sullivan read before the Western Railway Club.

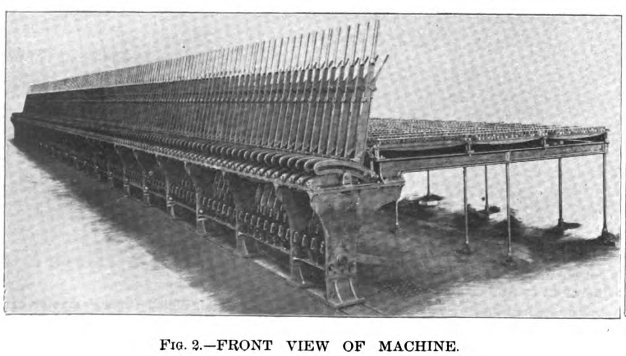


Fig. 2.—FRONT VIEW OF MACHINE.

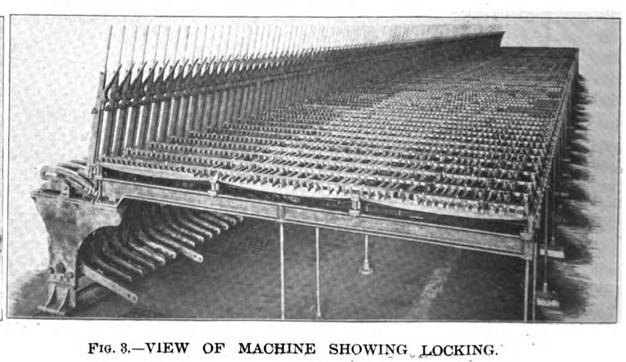


Fig. 3.—VIEW OF MACHINE SHOWING LOCKING.

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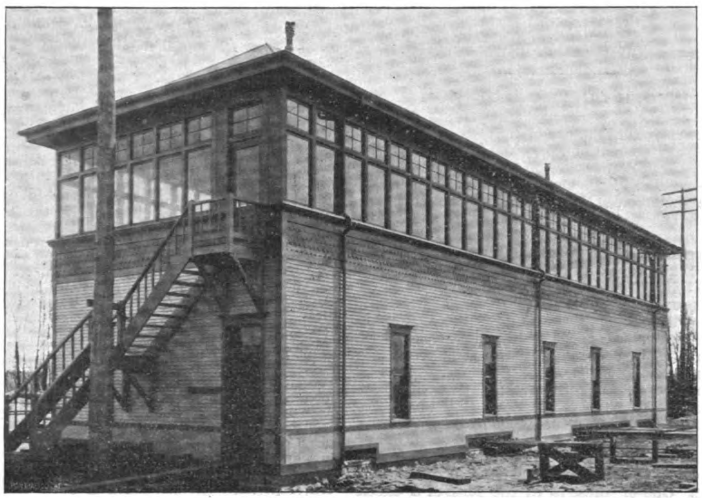
by a deterioration in the quality of the castings. Conscientious founders will maintain the quality and probably fail for the want of profits rather than sacrifice their reputation for good goods. Others may try to save themselves by "skinning" in the quality of their work and their customers may also be subjected to this process. The result of this will be a check to the use of malleable castings. The writer suggests that much trouble may be saved to both manufacturers and users by working to specifications. This course would fix the bottom prices at which it would be profitable to sell or buy malleable castings.

There is no dispute now that it is profitable to users to pay an additional cent or more per pound for malleable castings than the prices for which the best gray iron castings can be bought. The reasons need not be mentioned here as they are generally recognized; but unless the quality is maintained there is no advantage in maintaining the substitution.

The scope of the specifications should be about the same as for gray iron, wrought iron, or steel, except that it would be useless to have the chemical tests. There is a good deal of material on the market called malleable iron that is but little if any better than gray iron. The competition of this mongrel material hurts customers and conscientious manufacturers as well. As "all that glitters is not gold," neither is all that is called malleable iron genuine; and the good and the indifferent or poor should be separated by intelligent specifications.

We all have heard of a few instances of purchasers requiring malleable castings to meet requirements as to strength, but they were in special cases such as in guaranty bonds, relief from consequential damages in case of breakages of castings, when castings were sold by brokers, the broker desiring protection against both the manufacturer and the purchaser. There being no standard of strength by which to be governed the requirements were not very rigid, being a compromise between good gray iron and the known minimum of strength for malleable iron. These requirements were better than none even if tensible strength only was specified. They barred out bad and indifferent material and gave both manufacturer and purchaser protection from material known to be malleable iron only by its stamp.



DOLTON INTERLOCKING PLANT—FIG. 4.—VIEW OF TOWER.

In the making of good gray iron castings there is a greater latitude in the selection of pig, and scrap, and of mixtures, than in making malleable iron castings. In making malleable iron castings greater care is necessary in melting, molding and rapping. As they contract in cooling after molding nearly ¼ inch in 1 ft., and as they expand in annealing ⅛ inch in 1 ft. two movements are given to the molecules of iron, and this must be taken into consideration all through the process of manufacture, from the selection of the different kinds and grades of pig and scrap, through the mixtures, melting, molding, packing and annealing; and particular care is required in making patterns to distribute the metal in as nearly as possible uniform masses. All abrupt changes in shape should be "eased" with fillets. In cleaning by tumbling, or otherwise, greater care is required than with gray iron castings because the heat of annealing "burns on" any sand not removed in cleaning. This is a serious matter if the castings are intended to fit over other parts and in castings which must be galvanized, because the zinc does not deposit upon the sand. Pickling does not always remove the "burnt on" sand. As dependence is placed not altogether, but largely, upon the "skin" of malleable castings, the cross section at any point should be such as to give as much outside surface as possible. This can be accomplished by cutting thick portions up into ribs and by coring out the inside of large sections. Notwithstanding that a given section of malleable iron is from 30 to 60 per cent. stronger than any equal section of gray iron, because of the comparatively very much reduced section of malleable iron, the metal should be free of blow holes, and the surface should be free of irregularities.

In submitting these specifications it is not expected that they will be accepted as complete or free from flaws. It is hoped that discussion will follow with the object of producing a set of specifications under which malleable castings, for railroad uses particularly, may be purchased and thus avoid the evils to which reference has been made. It is not thought well to control the manufacturers in any way but in the results; unless it might be, in selecting whether the iron shall be cupola or air-furnace melted.

The practice that is followed in grey iron work in casting a test piece in the same mold with the casting proper can hardly be followed in getting malleable iron test pieces. The condition of gray iron castings is supposed to be uniform throughout in a given casting or in any number of castings from a variety of patterns representing thick and thin sections, while in malleable castings the annealing is most effective on thin sections. Therefore a solid test piece of malleable iron would hardly represent a lot of malleable castings from a variety of patterns; and a ribbed and cored test piece that would fairly represent such a lot of castings would be nearly as difficult to make. These are the principal reasons for recommending that test pieces shall be taken out of a finished casting; one or more pieces from different castings (patterns) to be taken at the option of the inspector. Of course, in this we would lose the benefit of the skin at the planed edges.

A casting should be selected from a miscellaneous lot that would give a test piece with the smallest section at or near the middle of the piece; this is to insure the piece not breaking in the jaws of the machine in tensile testing and to prevent it from breaking on the supports in transverse testing. As there is but little, if any, reduction of area, the cross section area may be left for determination after breakage. This allows of test pieces being taken out through flats, ribs, fillets and coring.

In 1891 and '92 a committee of the Master Car Builders' Association reported the results of some tests on specimens of malleable iron castings. The finding of the committee was for a tensile strength of from 25,000 to 34,000 lbs. per square inch. Since then a considerable advance has been made and we are justified in expecting better things. The figures for tensile strength that I will recommend are not as high as one manufacturer has expressed a willingness and ability to guarantee. The specifications submitted for discussion and possible revision are as follows:

TENSILE REQUIREMENTS.

At the option of the inspector, one, two or three castings of either one or different patterns shall be selected from each 2,000 lbs. of finished product. From one or all of the castings thus selected test pieces shall be cut and prepared; one from each selected casting. The position in the casting from which the test piece shall be cut is to be determined by the inspector. The size of the test piece shall be, as nearly as possible, such as will give when the piece is prepared, a uniform clear length of 4 in. between the grips of the testing machine, and such as will give as nearly as possible a cross section area of ¼ sq. in. Tests of one or each of the pieces thus prepared shall show a tensile strength of not less than 40,000 lbs., and not more than 47,000 lbs. per square inch. The elongation and reduction of area measured after fracture shall be distinctly noticeable as indicating some degree of ductility and should be at least 1.5 per cent for each. Should the average of three tests show a tensile strength below 43,000 lbs., and coupled with this, if ductility is not plainly discernable, the inspector shall have the option of repeating the test.

TRANSVERSE REQUIREMENTS.

Besides the tensile tests, transverse tests shall be made as follows: From the same castings or others at the option of the inspector, one, two or three test pieces shall be prepared, giving a length of 12 in. between centers of supports and having as nearly as possible a cross section of 1 in. square. If there should be any difference in the dimensions of the sides, the piece should be set in the machine with the greater dimension vertical.

The supports shall be 12 in. apart, center to center, and of the usual shape for making transverse tests of grey iron castings. Tests of one or each of the test pieces thus prepared shall show an ultimate transverse strength of from 3,900 to 4,800 lbs. per square inch, and deflections from 0.35 to 0.65 in. The average breaking load for any number of tests should be about 4,300 lbs. per square inch and the average deflection about 0.5 of an inch; this for specimens of the sizes recommended and for a metal of the characteristics suitable for car castings.

The fractures in both tensile and transverse tests should be fine grained and uniform; blow holes should be absent; bright edges like the chill in chilled castings should generally show distinctly at the edges; the center should generally appear almost as dark as burnt iron. No great dependence, however, can be put upon an examination of the fracture in determining the quality of malleable castings, further than seeing that castings are of uniform fine grain and free from blow holes, as the fracture will vary in appearance according to the size of section.

BENDING AND TORSIONAL TESTS.

Malleable castings which successfully pass the above requirements in tensile and traverse tests will generally successfully pass bending and torsional tests of equivalent severity. Reasonably thin sections, about 3-16 to 9-16 in. thick by about 1 to 3 in. wide should bend over on themselves around a circle at the bend equal in diameter to twice the thickness of the piece and back again straight. And in torsion a thin piece of uniform dimensions or nearly so, should twist once around without fracture. It only requires proper mixtures and proper annealing, coupled with care in other particulars, to make malleable castings that will weld on themselves; that will draw out to a knife edge on an anvil under a hammer; that will temper and cut soft iron like a cold chisel. Such castings, however, cannot be had at the prices at which some malleable castings are quoted, and probably such qualities are not required in car castings.

WOOD AND PEAT AS LOCOMOTIVE FUELS.

In his presidential address before the Canadian Society of Civil Engineers Mr. Herbert Wallis offered some figures upon the use of different fuels upon the locomotives of the Grand Trunk Railway. The following paragraphs taken from the address contain his references to the use of wood and peat on the early locomotives which are of historic interest:

I do not claim that my conclusions have been reached as the invariable results of exhaustive experiment, or that my figures are beyond criticism. They are suggested rather as a contribution to practical literature upon a subject which has occupied in the past, and which will unavoidably continue to occupy, the minds of those engaged in solving the great problems arising from the frequent calls for cheaper and more rapid transportation, in connection with which this question of fuel through the energy derivable therefrom stands out as the prominent feature.

The fact that the coal bill alone in the accounts of our great railways absorbs some 14 per cent of the total expenditure is sufficient to constitute it, as it literally is, a burning question.

Years ago, when fire-boxes were made of copper and tubes of brass, when their repairs caused no anxiety in the minds of those engaged in the daily work of operating railways, and when their renewals did not constitute an important feature in the general expenditure, the forests of Canada supplied a staple fuel for locomotive consumption.

It is true that trains had to be stopped every forty miles or so, to have the tender loaded with a fresh supply, an operation which occupied ten or fifteen minutes; but these were halcyon days, when time was not so valuable, because competition was not so keen as it is to-day, and no inconvenience apparently resulted from the not infrequent arrival of passenger trains long after their schedule time.

It was only when the possibility of sharing in the distribution of the great produce of the west suggested an assimilation of the gage of the Grand Trunk with that of the American lines, that it was seen how totally inadequate was cordwood to meet the requirements of a first class railway service.

Even then the substitution of coal had to be gradually effected, on account of the expense attending the conversion of the locomotives. A wood-burning engine was *hors de combat* after a very short tussle with coal, and the renewals of fire-boxes and tubes were of such a costly nature, as to suggest oftener than not, the substitution of an entirely new engine and the relegation of the old one to the "scrap" heap.

It is not therefore to be wondered at that cordwood outlived for many years the introduction and even the extensive use of coal, particularly upon branch lines, from the neighborhood of which it could for many subsequent years be obtained cheaply, and in other districts where competition was the least active, to the extent necessary to wear out those locomotives, which, while being still equal to service, were not worth the expense of conversion.

Fuel wood was purchased by the measure, in cords of 128 cubic feet, and was delivered under various contracts upon the railway "right of way" at the nearest points to

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