book, the report is taken directly to that book, thus saving copying. Without this saving the plan would be too expensive, but with it there is a saving.

Mr. J. R. Kavanaugh, of the Chicago, St. Paul & Kansas City, read a paper on "The Car-service Department of the Future," in which he advocated the keeping of the railroad mail service account and the switching accounts, grain door records, seals and seal records by this department, as well as the supervision of fast freight movement and the distribution of passenger cars. Mr. C. H. Cannon, of the Great Northern, described the practice of his office in keeping the record of locomotive performance, which has been done since April, 1888. The record is a useful check on errors of enginemen and timekeepers, and is believed to be worth many times its cost.

The Hall Signal Co.'s Mechanical Interlocking.

The Hall Signal Co., of New York and Chicago, which has hitherto confined itself to electric signals, has recently taken measures to add a department to its shops for the manufacture of mechanical interlocking machines, as well as signals and the usual accessories, and an 8-lever interlocking machine built by the company is now on exhibition at its office in New York (50 Broadway).

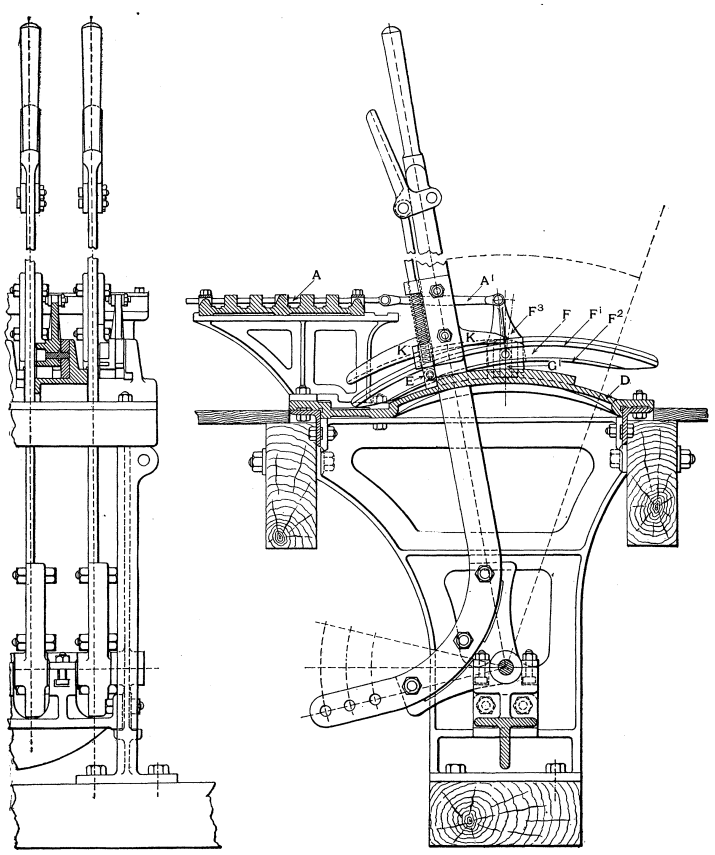
The accompanying figure shows the style of the machine. The locking is of the ordinary Stevens type with mitre locking. The chief peculiarity is the movable pivot for the rocker, this feature having been invented by Henry Bezer and Thomas W. Burley, who have applied for patents upon it. Mr. Burley is signal engineer of the Lehigh Valley, and Mr. Bezer, who was formerly connected with the English signal manufacturer, Sykes, is now employed by the Hall company.

The principal claim made for this machine is that excessive wear and strain on the lever and on the frame generally, are obviated by pivoting the arm $F3$, at its lower end and the rocker F on a pin which slides up and down in a bracket fixed to the frame. All the locking and its actuating mechanism are above the floor level.

There are ribs F^1, F^2, cast on the rocker F, and within them fits the roller E. When the catch rod is lifted, the catch is clear of the projection on the stationary segment D, and the roller E will have raised the rocker F. Then the upper face of the rib F^1 will be against the shield K. The arc of that face of K which engages with the rib F^1 is concentric with the lever; also the faces of F^1, F^2, when the rocker F is raised as just described. The adjustment of the catch rod is such that when the clutch is brought against the lever the lower end of the catch rod is just clear of the projection on D and F^1, and therefore the rocker F is controlled by K. Although not compulsory, it is preferable to grasp the clutch and the lever H when moving the lever to either position. This keeps the catch rod just clear of the projection on D.

It will be seen that throughout the movement of the lever there is next to no movement possible for the rocker F, because of the control of the shield K. Even if, in consequence of wear or inexact fitting of parts, it became possible to bring the rocker F to a position eccentric with the lever, the slide G^1, to which the rocker F is pivoted, can rise with the rocker, so that there would always be a path for the roller E without that kicking and breaking strain which would result were the rocker pivoted to a fixed base. In other words, as the rocker is pivoted to a movable base, it can adjust itself concentrically with the main lever.

It will be understood that when the catch rod is lifted from one end of the projection on D and is dropped into the other end, the rocker F, through arm F^3 and link A^1, operates the tappet A in the usual manner, and that the movement of the tappet A can be the minimum of what the mitre locking requires, because of the rigid conditions of the rocker F during the movement of the lever H from one position to the other.



INTERLOCKING MACHINE—HALL SIGNAL COMPANY.

Manganese Steel.

In a paper read before the American Society of Mechanical Engineers, at Providence, in June, Mr. H. M. Howe brought forward the most prominent characteristics of manganese steel.

Starting with the fact that small proportions of manganese have but little effect on the hardness, strength or ductility of iron, he placed the first visible predominant effect at about 2.5 per cent. Then, "as the proportion of manganese rises above 2.5 per cent. the strength and ductility diminish, while the hardness increases. This effect reaches a maximum with somewhere about 6 per cent. of manganese. When the proportion of this element rises beyond 6 per cent. the strength and ductility both increase, while the hardness diminishes slightly, the maximum of both strength and ductility being reached with about 14 per cent. of manganese. With this proportion the metal is still so hard that it is very difficult to cut it with steel tools. As the proportion of manganese rises above 15 per cent. the ductility falls off abruptly, the strength remaining nearly constant till the manganese passes 18 per cent., when it in turn diminishes suddenly." "Steel containing from 4 per cent. to 6.5 per cent. of manganese, even if it have but 0.37 per cent. of carbon, is reported to be so extremely brittle that it can be powdered under a handhammer when cold; yet it is ductile when hot." Another instance where the properties of the alloy differ widely from the mean of the properties of the components.

The paper then dealt exclusively with the great hardness of the metal combined with its high tensile strength, and astonishing toughness and ductility, merely mentioning the other properties of freedom from blow holes, difficulty of welding, increase of toughness by quenching from a yellow heat; its enormous electrical resistance, and low thermal conductivity.

In its resistance to abrasion manganese steel excels all other steels when tested on an emery wheel, but when applied to a smooth revolving shaft it falls below blue tempered hard tool steel by 60 per cent.

As for the hardness of manganese steel, it "seems to be of an anomalous kind. The alloy is hard, but under some conditions not rigid, as it can be bent double cold without cracking. It is very hard in its resistance to abrasion; it is not always hard in its resistance to impact."

Reference is not made "to the mere fact that it can be indented by a sharp blow," for "this power of enduring distortion is almost a necessary consequence of its great ductility;" but "to its behavior under conditions like those of a hammer head," where it has not met the expectations of its promotors.

In testing the metal in the shape of car axles, it withstood blows representing 43 per cent. more energy, yet with a very much less total deflection than the carbon axle with which it was compared before breaking. Again, in comparing a manganese steel car wheel weighing 612 lbs. with cast iron wheels from the best makes, the total energy represented by the work done in breaking the former was 18 times as much as in the case of the latter.

It is in the field of car wheel work for passenger cars that the author expects to find one of the widest applications of the metal.

"To sum this up, in resistance to abrasion alone, manganese steel excels the hard carbon steels (when unhardened) and *a fortiori* the soft steels. Where both abrasion and repeated shocks are to be resisted, manganese steel is certainly less liable to break than the hard carbon steels; but whether, under new conditions, combining shock and abrasion, it will prove as rigid as the carbon steels with which it will then have to compete, direct experiment alone can tell."

The peculiar properties of the metal naturally raise numerous problems for its successful and economic working. But inasmuch as it forges readily at a yellow heat, it is suggested that it be worked in this condition to a shape more nearly coinciding with the finished lines than is usually done. Still there must be a certain amount of cold working done, and the emery wheel which cuts manganese steel very readily is the resort.

It has been found that this steel is peculiarly well adapted for use in bridge pins, as the wear of those in service is very much less than carbon steel. At first the problem of cutting the thread for the lock nuts was a serious one, but it has been solved by using Wyman & Gordon's machine for forging threads. While the metal is quite ductile its resistance to drawing is so great, and it requires such frequent annealing, that it is doubtful if it meets with a very wide application in this direction. Up to the present time the established uses for manganese steel are few. The most important use is as the pins for holding the buckets of dredgers, then comes that of links in common chain elevators. The cyclone pulverizer is made with blades of manganese steel, where it has been found to fill every requirement. "A great many points and crossings have also been made for both steam and horse railroads, but it is not yet known how the wear of manganese compares with that of carbon steel under these conditions."

"Finally, it is to be expected that manganese steel should make excellent armor plates, for here hardness and toughness should be combined. The plate must be so hard that the shot does not penetrate it, yet so tough that it does not crack and let the water in; and such experimental data as we have, indicate that it will fulfill this expectation."

From all that has thus far been learned then it is safe to assume that despite the difficulties in its manipulation that would seem at first sight to act as a barrier to its introduction, the peculiar hardness, tensile strength and ductility of manganese steel must serve both to "create and limit its value in the arts."

The Department of Transportation at the World's Fair.

The Department of Transportation is to be one of the great coördinate departments of the World's Columbian Exposition, and it is the intent that this department shall fully present the origin, growth and development of the various methods of transportation used in all ages and in all parts of the world. Past history will be illustrated, and it is hoped, that, in the interest of historical accuracy and the preservation of important relics which are now daily passing away, the attention of the

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