mined for 50-car trains of both the Westinghouse and New York brakes, we are in possession of a formula which permits very accurate reductions of the running tests to a uniform basis of speed, and therefore permits a more accurate comparison of stops in running tests than has been possible heretofore. The values of "t" for the different trains and conditions are given in Table G.

TABLE G OF VALUES OF $1.47t$ AND $1.47tV$.—FOR TRAINS USED IN ALBANY TESTS.

Train.	$1.47t$.	$1.47tV$.
Westinghouse	2.57	77.1
New York	3.45	103.5
Mixed—45 cars	2.85	85.5
Mixed—55 cars	3.24	97.2

Interlocking at Forty-third Street, Chicago—Illinois Central Railroad.

The National Switch & Signal Company, of Easton, Pa., is providing for the Illinois Central Railroad some large interlocking apparatus, as was noted in our issue of Feb. 10. A 92-lever machine for Twelfth street, at the entrance to the new station, is building, and an 80-lever machine for Forty-third street has been shipped. The latter machine has 77 working levers and three spare spaces, and will operate 52 switches, 7 movable frogs, 66 locks and 37 signals. These switches and slips are provided with 2,700 ft. of detector bars. No selectors are used in this plant.

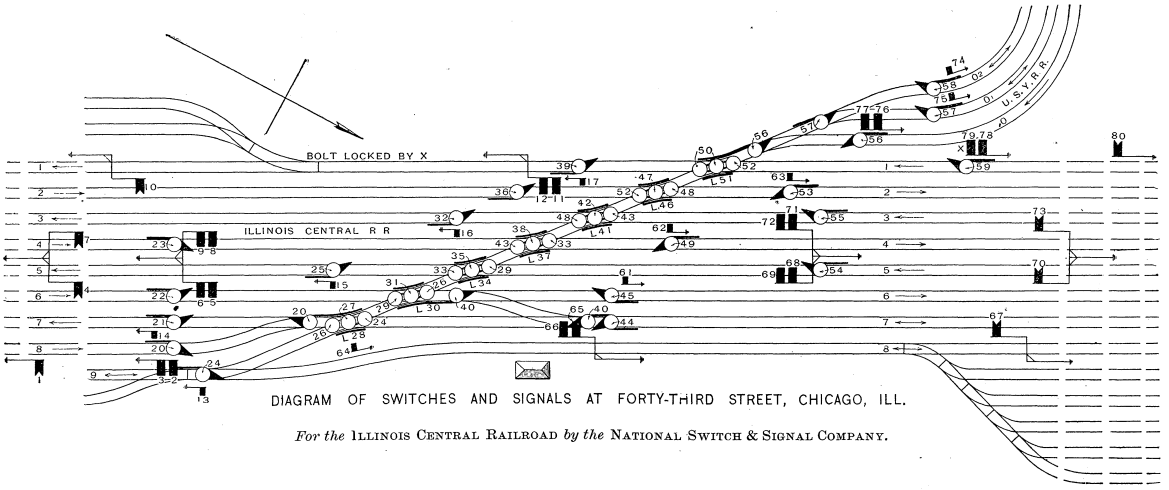


DIAGRAM OF SWITCHES AND SIGNALS AT FORTY-THIRD STREET, CHICAGO, ILL.

For the ILLINOIS CENTRAL RAILROAD *by the* NATIONAL SWITCH & SIGNAL COMPANY.

By examination of the plan of the layout it will be seen that the nine tracks are crossed by a straight crossing, having seven sets of No. 7 movable frogs and double slip switches, and that there are besides several single switches leading to the sidings. Each track except No. 8 has a derailing switch on each side of the crossing. These derailers are placed 300 ft. from the crossings in the running direction and 150 ft. in the reverse direction. The plant is well concentrated for so large a one; the greatest distance of any switch is 591 ft. from the tower, and the total connections required but 16,500 ft. of pipe and 64,000 ft. of wire. The tower is a frame structure 12 ft. 2 in. by 37 ft. 8 in.

The locking for the crossings is very heavy as may be illustrated by the following schedule of the locking of one lever, No. 13, which has the heaviest locking of any lever in the machine. The letter N following the number of each lever indicates that it is locked in its normal position; those not so indicated are locked in their reverse position:

Lever 13 locks 24 N or 24, (27 with 24 and 26); (28 with 24); (30 with 24 and 26); (31 with 24, 26, 29); (34 with 24, 26, 29); (35 with 24, 26, 29, 33); (37 with 24, 26, 29, 33); (38 with 24, 26, 29, 33, 43); (40 N with 24, 26 N); (40 N with 24, 26, 29 N); (41 with 24, 26, 29, 33, 43); (42 with 24, 26, 29, 33, 43, 48); (44 with 24, 26 N); (45 with 24, 26, 29 N); (46 with 24, 26, 29, 33, 43, 48); (47 with 24, 26, 29, 33, 43, 48, 52); (49 with 24, 26, 29, 33, 43 N); (51 with 24, 26, 29, 33, 43, 48, 52); (53 with 24, 26, 29, 33, 43, 48, 52 N); (54 with 24, 26, 29, 33 N); (55 with 24, 26, 29, 33, 43, 48 N); (56 N or 56 with 24, 26, 29, 33, 43, 48, 50, 52); (57 N or 57 with 24, 26, 29, 33, 43, 48, 50, 52, 56 N); (58 with 24, 26, 29, 33, 43, 48, 50, 52, 56 N 57 N); (59 with 24, 26, 29, 33, 43, 48, 50 N, 52); (61 N with 24, 26); (62 N with 24, 26, 29, 33); (63 N with 24, 26, 29, 33, 43, 48); (64 N); (65 N with 24); (68 N with 24, 26, 29); (71 N with 24, 26, 29, 33, 43); (74 N with 24, 26, 29, 33, 43, 48, 52); (75 N with 24, 26, 29, 33, 43, 48, 52); (76 N with 24, 26, 29, 33, 43, 48, 52); (78 N with 24, 26, 29, 33, 43, 48, 52).

While this is, as we have said, the heaviest locking on any lever in the frame, there are many others which have a great deal of locking. In our notes on the works of the National company, published Feb. 10, we mentioned the fact that in this machine the locking is done both on the front and on the back of the frame by hanging tappets from both ends of the rockers, and this, we are told, is the first machine to be built in the United States with the locking applied in that way. The arrangement is found convenient and economical of space where such heavy locking is required. There is a great deal of special locking to be done, and for this the Pfeil cylinder special lock is used, a description of which with illustrations follows. Before passing to that, it will be interesting to the student of interlocking to notice the lever movements required to pass one train, say from track 2 to track 9, which is as follows: 24, 26, 27, 28, 29, 31, 30, 33, 35, 34, 43, 38, 37, 48, 42, 41, 52, 47, 46, 50, 51, 58, 74; total levers, 23; it being understood that the levers must be reversed substantially in the order given above.

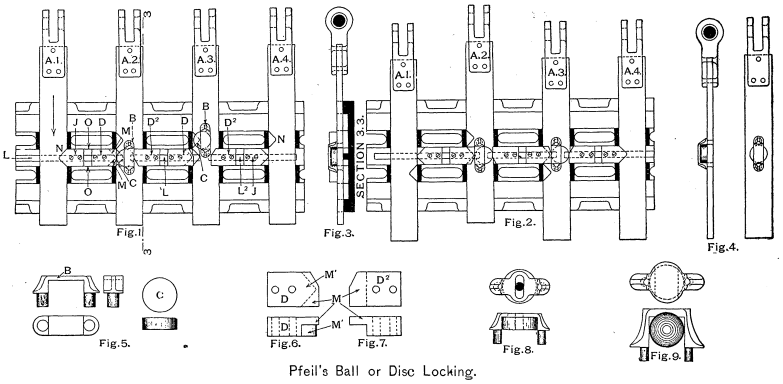
There are in all 142 routes for which signal can be given, and eight movements can be made at one time.

PFEIL'S NEW LOCKING.

The locking used on this machine is new and is the invention of Mr. George H. Pfeil, Chief Engineer of the National company. It can be used either with a disc, cylinder or ball, and besides being anti-friction adapts itself readily to special interlocking. A description follows.

In the old form of locking the slide was usually a rectangular section fitted between the transverse straight guides on the tappet and capable of rectilinear movement only. The consequence was that in practice the slides were very apt to cock and jam in their guides, thus rendering the action of the machine uncertain. Moving with friction and requiring considerable force to operate them, they, at times, jammed tight and completely blocked the machine. With the roller which is held loosely on the tappet, so that it is capable both of rotary movement on its axis and of movement crosswise of the tappet the operation of the lock is practically frictionless, so far as concerns the dogs and itself.

In prior arrangements the slides themselves have been



Pfeil's Ball or Disc Locking.

notched to directly interlock with the dogs, and have thus constituted the means by which the locked tappets were restrained from movement. With the Pfeil locking the notches are in the tappets while the rollers or cylinders are simply the anti-friction intermediaries whereby the dogs are actuated to engage or leave the notches in the tappets.

The manner in which this locking is carried into effect will be understood by reference to the accompanying cuts. Fig 1 is a plan showing tappets, rollers and dogs in their normal position. Fig. 2 is a similar plan with tappets 1, 3 and 4 reversed. Fig. 3 is a section on line 3-3, Fig. 1. Fig. 4 is an edge elevation of one of the tappets. Fig. 5 is an end view of roller guide or yoke. Fig. 6 is a side view of dog D. Fig. 7 is a side view of dog D 2. The tappets are mounted and connected to the levers in the usual manner, and the locking bars are adapted to slide transversely of the tappets.

Upon the lock bar L are fixed the dogs J D, which are located between tappets A^1 and A^2, and like all the other dogs move in guides O in the frame. Upon the second lock bar L^1 are fixed the dogs D^2 and D, which are located between the tappets A^2 and A^3, and upon the third lock bar L^2 are fixed the dogs D^2 and J, which are located between the tappets A^3 and A^4. The dogs J are of the ordinary kind, having V or miter-shaped noses to engage similarly shaped notches N in the sides of the tappets.

There is one notch in the tappet A^1, two in tappet A^2, two in tappet A^3 and one in tappet A^4. In fig. 1 the notch in tappet A^1 is represented as engaged and filled by the dog J on lock bar L; the other dogs are out of engagement with the notches.

On each one of the tappets A^2 and A^3 is a cylinder C which is loosely placed in a guide yoke B, of the form shown in figs. 1 to 5 inclusive, the yoke B being fastened by its legs to tappet in a position to permit the cylinder to move bodily transversely of the tappet. This cylinder, in addition to this bodily movement, can also rotate on its axis, or, in other words, it can roll from side to side of the tappet. The dog D has an extension M to operate on the roller, and is provided below this extension with a miter nose M^1, to engage the miter notches on the adjoining edge of the tappet, with which it co-operates. The dog D^2 has a like extension M, for a like purpose, but it has no miter nose for the reason that in the particular arrangement shown in the illustration the edge of the tappet adjoining it is plain and unnotched.

The operation is as follows: In fig. 1 all of the tappets are normal, a position in which the cylinder C of tappet A^2 is in the path of the dogs and the cylinder on tappet A^3 is above the path and out of the range of the dogs, and the miter nose of the dog J of lock bar L is in engagement with the notch N of tappet A^1. All of the tappets in this position are unlocked. If now tappet A^1 be reversed (its movement for this purpose being in the direction of the arrow placed on it in fig. 1) it will push dog J and lock bar L to the right, and as dog D is attached also to the same lock bar L as dog J, it will lock tappet A^2 by its nose M^1, and at the same time by its extension M will push the cylinder C of tappet A^2 over against dog D^2 in lock bar L^1, and consequently will move the dog D of that lock bar. Also in this way the tappet A^3 is locked, but inasmuch as its cylinder C is out of range of the dogs no movement is communicated to lock bar L^2, and consequently the tappet A^4 is left unlocked and free to move.

By reference to fig. 2 it will be seen that A^2 normal, A^3 and A^4 reversed are locked by lever A^1 reversed. In all of these movements, as well as others of which the apparatus may be rendered capable, the cylinders transmit movement to the dogs with entire certainty. They are not liable to cramp or jam in their guide ways; any tendency to this is neutralized and prevented by their capacity to revolve, as well as to move bodily in a transverse direction, so that all danger of the blocking of the machine is obviated while there is great freedom from friction and consequent ease of manipulation. The arrangement shown in figs. 8 and 9 can be used in place of fig. 5.