ROUTE-LEVER SIGNALLING, WINCHESTER, GREAT WESTERN RAILWAY.

By the Ferreira-Insell Route-Lever Signalling the actuation of one lever simultaneously moves, or holds, all the point levers, and then lowers the requisite signal for a required route.

If the files of the *Railway Engineer*, particularly those for the years immediately prior to and immediately succeeding the year 1910, were searched there would be found described therein several schemes for one lever actuating the points and signals for each route possible at a signal box. All these ideas were of French origin, and it is not without interest to know that the first such was designed to meet possible labour troubles. The road, in this, the original, scheme, was " made " by the turning of a key, so that it pointed to the direction in which the movement was to be made, *e.g.*, if to be to the up line the key had its pointer turned to " up line " ; if for No. 2 siding then to " No. 2 siding." From what we saw of these arrangements at that time they appeared to do their work properly, and their somewhat extensive use, particularly on the Northern and Eastern Railways of France, suggested that they gave satisfaction.

Fig. 2.—Typical Point Lay-out.

The system of route-lever signalling we are now about to describe achieves the purposes mentioned above, but, in general, by means identical to most power-signalling methods. In the type of locking frame and in the signal and point mechanism and actuation there is very little dissimilar from the all-electric power systems hitherto seen in this country.

The Lay-out at Winchester.

Fig. 1 is a diagram of Winchester, Cheesehill, station, which is situate at the southern end of the Didcot, Newbury and Southampton section of the Great Western Railway, and just short of where that line joins, at Shawford Junction, the Southern Railway main line between London and Southampton. The line is single, and Winchester is a passing place, with a siding, mainly for horse-boxes, on the up side, and one, leading to a goods yard, on the down side. The single line thence to Shawford Junction is operated by the electrical tablet, and we would here remark that since we visited the installation the tablet has been made to control No. 14 starting signal and No. 15 inner home. The section Winchester—King's Worthy is operated on the token system.

Winchester is not, in our opinion, sufficiently large fully to demonstrate the possibilities of route-lever signalling as compared with the usual power signalling, which latter, as is known, needs much fewer levers than mechanical signalling. A case in our mind, better illustrating these possibilities, is where there are two crossover-junctions. This requires to-day 40 working levers for mechanical operation, would need 28 were it power signalled, but only 17 route levers would be necessary.

At Winchester there are 16 levers in the locking frame, which are allotted as lettered in the locking list, Fig. 1. No. 9 is the king lever which is referred to below under the cross heading " Individual Operation." In addition to these 16 levers there are, as also referred to below, six slides on the

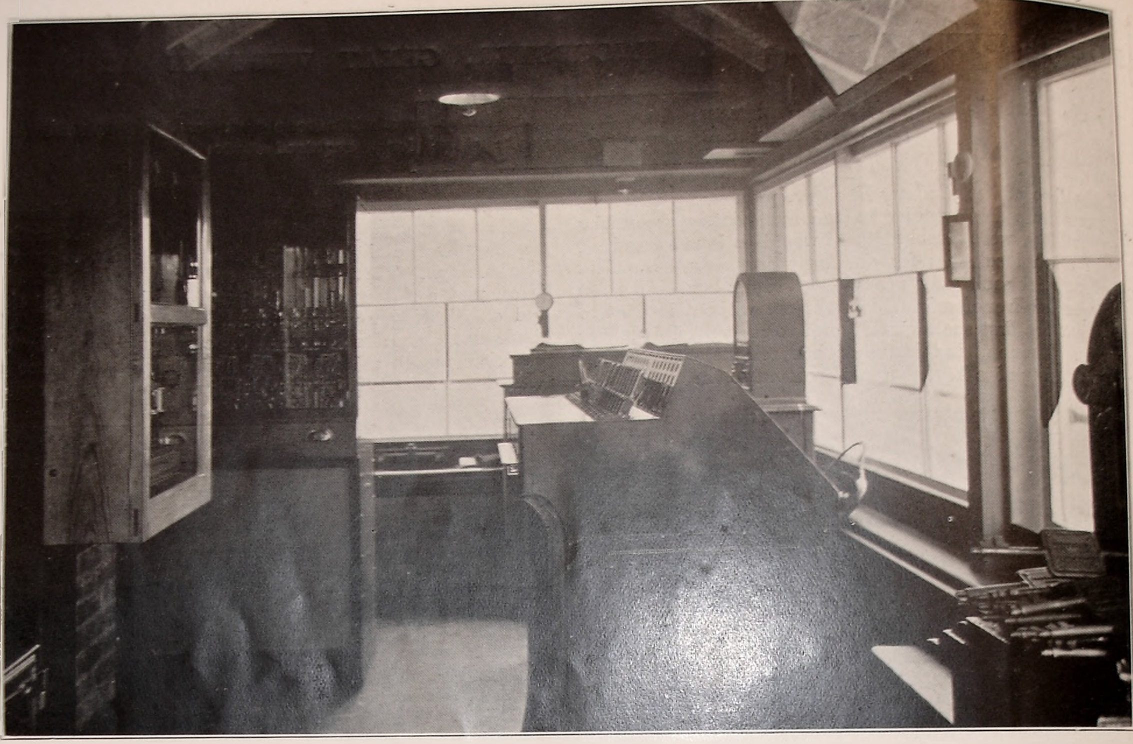


Fig. 3.—Interior of Signal-Box.

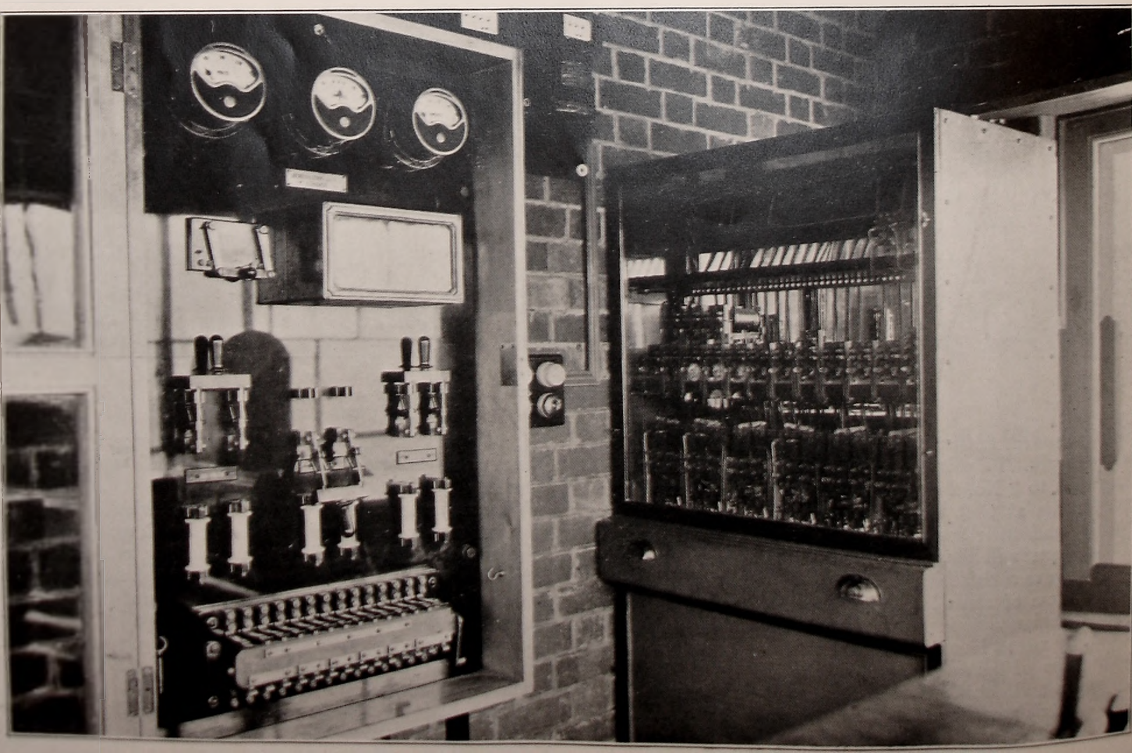


Fig. 4.—Power Switchboard (left) and Contactor Case (right) in upper part of Signal-Box. Batteries in lower part of Signal-Box.

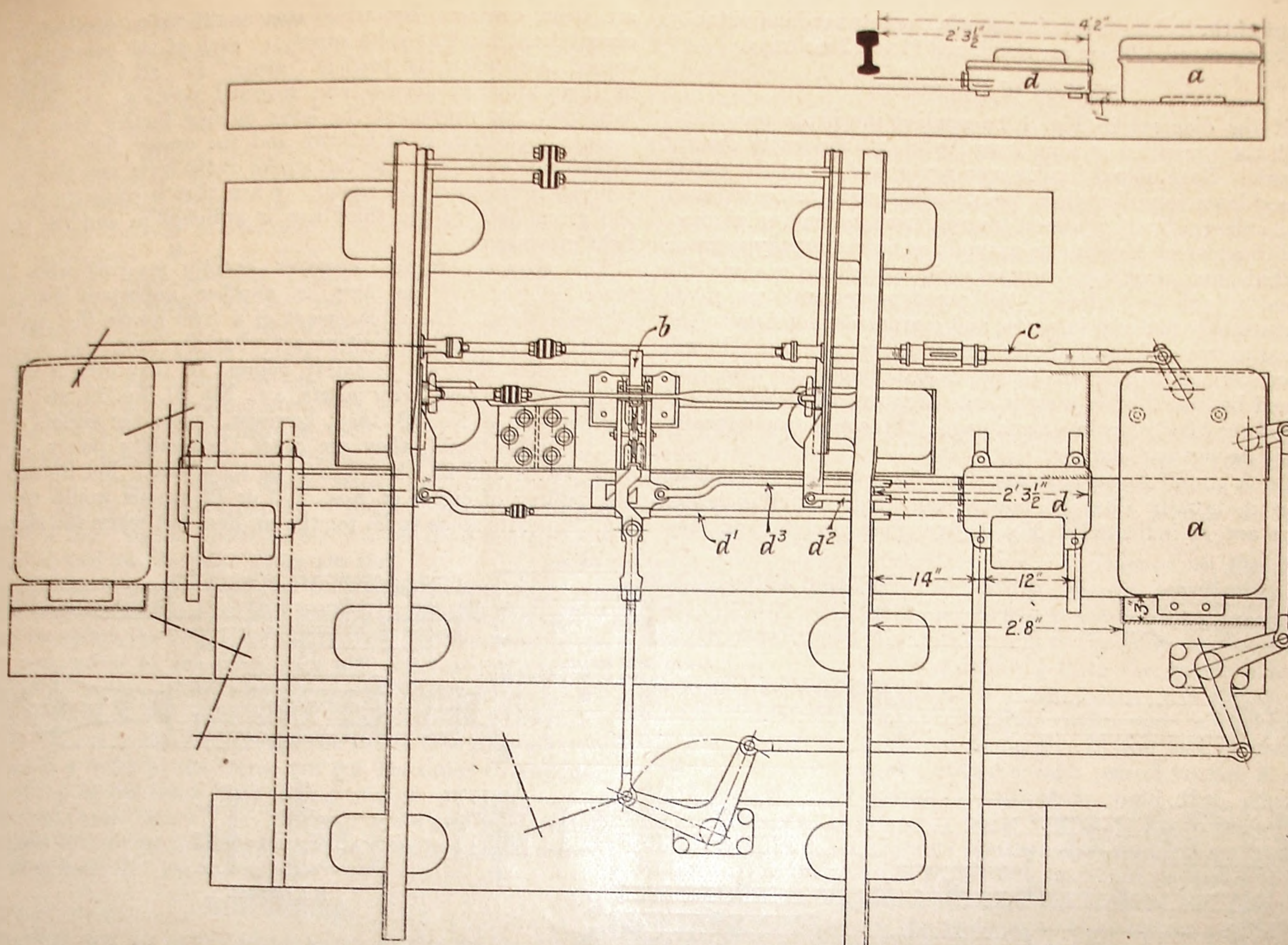


Fig. 5.—Facing Point Equipment.

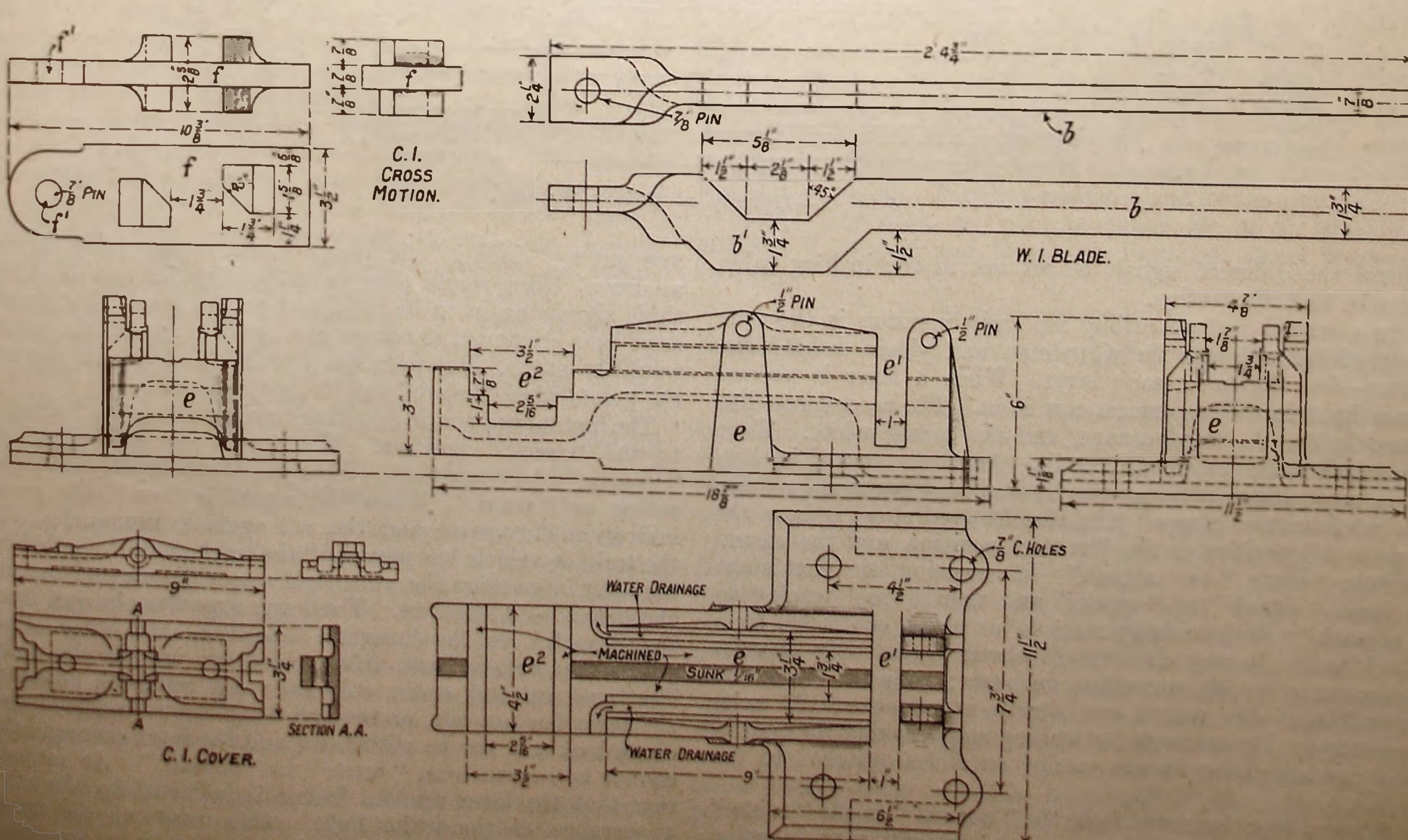


Fig. 6.—Great Western New Facing Point Lock.

front of the locking frame for use when points need individually to be operated. These are numbered 17 to 22 inclusive.

Method of Operation.

If the diagram in Fig. 1 be studied it will be seen that, with the exception of king lever No. 9, all the levers control signals. Each signal has its own route, and when the determined lever is pulled those points which need to be reversed are, unless already reversed, moved from normal to reverse, and those which have to be normal are, unless already normal, shifted from reverse to normal, and when this is done the signal is put to "clear." All point movements are made concurrently and not in series, and current cannot flow to the signal unless and until all the points are in position. It will be convenient to add at this point that should the road concerned be fouled after a signal has been put to "clear," or if any of the affected points be damaged, the signal automatically would be put to "danger."

Track circuit forms a greater basis in route-lever signalling than it usually does in power signalling. At Winchester there are, as indicated in Fig. 1, five track circuits, and they control the different signals as set out in the locking table given in that illustration.

An essential feature calling for early mention is the four rows of lights facing the signalman and placed behind the levers—four lights for each lever. When a lever is normal a red light in the uppermost row is in. The second row has green lights, the third orange, and the fourth white. Their purpose will be described directly. Another essential is that, as in most power systems, the forward and backward strokes are made in two stages. The first forward stage is from the "normal" position to the "route" position, and the second is from "route" to "signal." In reversing, the first stage is from "signal" to "track," and then from "track" to "normal." Each midway stage is, as usual, controlled by a check lock. It may also here be observed that only 24 volts is necessary for all controlling purposes; only for the actual operation of the points and signals is power at 120 volts necessary. The contacts for making and breaking the control and operating circuits are carried on slides attached to the levers.

When a lever is moved from the "normal" to the "route" position, the track circuits concerned, operating at 24 volts, cause, provided the tracks affected are clear, the respective white light in the bottom row to be switched in. If the tracks are clear, contacts, operating also at 24 volts, complete a circuit from the 120 volts supply to each of the points concerned, and when the road is "made," *i.e.*, all these points in their required normal and reversed position, the check lock that has prevented the lever moving further than the "route" position is withdrawn and the orange light in the second row appears. The full stroke of the lever now may be completed to lower the signal. When that is correctly done the green light in the third row is switched in and the red light disappears.

This sequence is not, however, exactly reversed when a lever is restored, as here is another important feature of the system. The replacement of a lever leaves the points unaltered, *i.e.*, in the position set when the lever was pulled over, unless they act as safety points. If they are, or have connected to them, trap points, *e.g.*, No. 20, No. 17, and the further end of No. 18, they, however, follow the signal. If, on the other hand, they are other than safety points, *e.g.*, Nos. 19, 21 and 22, they remain as they were. For instance, the pulling of either of Nos. 2, 3 or 12 signals would move No. 22 points so as to lie for the up line, but when the signal was put to "danger" the points would remain lying for the up line. They would thus be in position for any of these three signals again to be used, and so the power that would have been employed to restore and again to reverse the points would be saved. But were No. 4 or No. 5 or No. 16 wanted, the points would respond and lie for the down line.

The first movement, in restoring a lever, is from the "signal" to the "track" position. This would put the signal to "danger," but would leave all the points unaltered, even those acting as "traps." When the signal is "on" the green indication disappears and the red again is illuminated. If the train or vehicle has passed off the track circuits controlling the lever in question the white light also is illuminated and the check lock is withdrawn. The lever may then be put from the "track" to the "normal" position, and when those points that are, or have, safety points are normal, the white light goes out and, again, only the red is seen. If, however, the train has not left, or the line be otherwise occupied, the check lock will not be withdrawn and the lever consequently cannot be moved from "track" to "normal." An intimation that the lever remains locked is indicated by the non-appearance of the white light. One result of the track circuits thus holding the levers is that there is no necessity to provide locking bars to the facing point plungers.

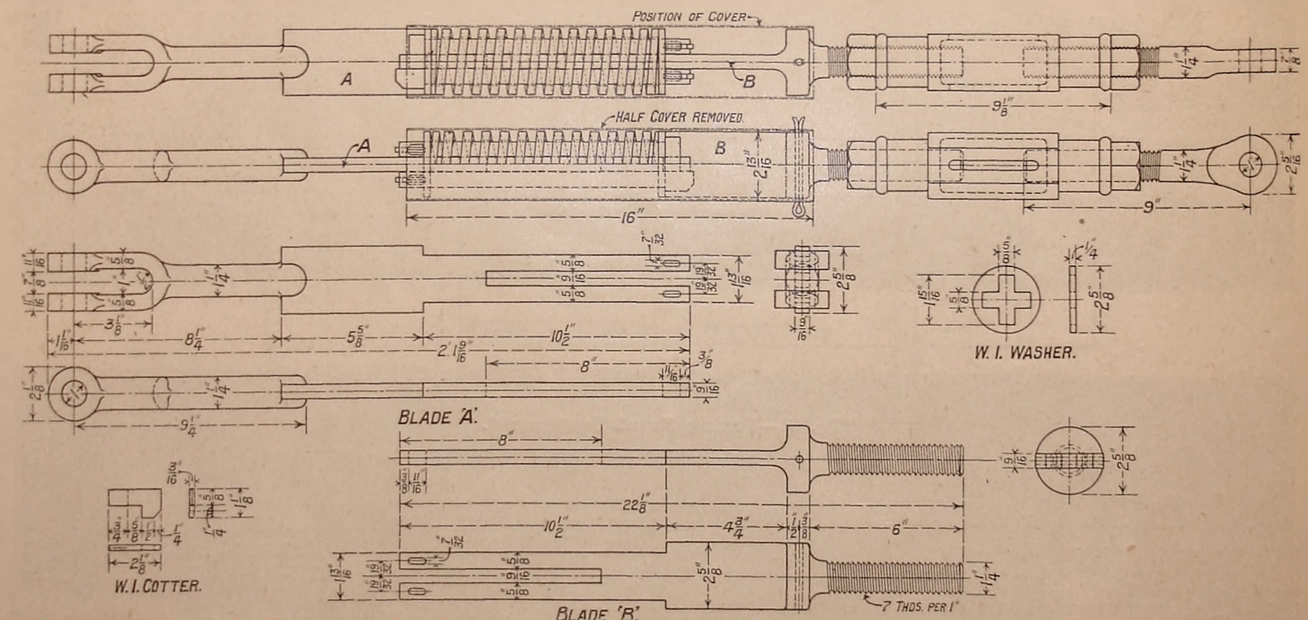


Fig. 7.—Details of Safety Spring.

Provision for Individual Operation.

There are, necessarily, times, *e.g.*, when points require cleaning, adjusting or repairing, when it is requisite to work a set of points independently of the complete route. For that purpose there are provided the six slides, already mentioned as in the front of the locking frame, which are numbered 17 to 22 inclusive, and connected electrically to the points numbered correspondingly on the diagram, Fig. 1. These slides stand normally in a midway or neutral position and have two indications. When in their normal position green is shown, and, when reversed, orange. These indications are operative at all times, whether the points are controlled by the route levers or are being individually operated. Those levers coupled to safety points show, however, red when reversed, in order to draw special attention to their position.

It is for this individual operation that the king lever is provided. It stands normally in the "route" position and is locked when there by every other lever in the frame, *i.e.*, every other lever must be normal before No. 9 can be moved from its "route" position. When pulled to the "signal" position every other lever in the frame is locked and all the point slides are free.

When the requisite work has been done to the points the slides must be restored to the neutral or normal position in order to replace the king lever and thereby free the route levers. The restoration of the king lever will automatically restore any safety points which may have been reversed during the manipulation of the point slides. Points other than safety points will, as in the former case, be left as last placed.

Should a lever in the frame not get the expected response, say, owing to the track relay failing to pick up, and it cannot be moved from "track" to "normal," this, generally, will be put right by moving the king lever from "route" to "normal" and then back to "route" again.

Interlocking.

As there are no purely point levers in the frame, all the interlocking is done through the signals. This is a feature that is contrary to the basis of interlocking wherein the greater part of the work is done through the point levers. This necessitates a larger number of locks but, actually, all "dead" locking is more easily achieved. What must have been troublesome was that the restoration of some signal levers would put certain points into their normal position whilst they were still required to be reversed. For that reason some of the locking does not come into play until the signal lever has been moved back from the "signal" to the "track" position. If each lever be traced through the locking list given in Fig. 1, some novel features will be found. The way in which the "road is held" is very clever. No. 16, for instance, when put to "danger," *i.e.*, when it reaches the "track" position, locks Nos. 1, 7, 8 and 10, and, therefore, none of those signals can be lowered until No. 16 has been put fully to the "normal" position.

The locking frame is of an entirely new design of Siemens Bros. & Co. Ltd.

Point Mechanism.

Fig. 2 is a reproduction of a photographic view of Nos. 18 and 19 points where the latter becomes the south end facing points of the passing loop. The points and motor mechanisms in the immediate foreground are No. 18; the next motor is coupled to No. 17 trap point, the single switch of which is seen on the extreme right, and the further points are No. 19, to which is coupled the furthest motor mechanism. The covers in the "four-foot" have been temporarily turned back, also the tops removed from the motor and detector cases.

The operation of the points will be better understood from Fig. 5, which is a copy of a drawing kindly supplied by Siemens Bros., and which may be imagined as illustrating No. 19 points. The motor is contained in the case *a*, and when the points are bolted, as in the case illustrated, the first movement withdraws the plunger *b*. By the time this is done the crank in the motor and coupled to the rod *c* becomes engaged, and the points are moved over. This completed, the crank comes to rest, but the motor continues to run, and the toggle, seen in Fig. 2, on the upper side of the wheel, having reached a central position, causes, when further actuated, a movement in the opposite direction to be given to the plunger so that the points are again bolted, but in their new position. Each of the two point switches is detected electrically in the case *d*; rod d^1 is from the further switch, rod d^2 from the nearer switch and rod d^3 from the plunger.

The detection of plungers is now a very important matter, and in Fig. 6 may be seen details of the new plunger adopted by the Great Western Railway. The plunger blade *b* moves in the casting *e* through the slot e^1 of which the stretcher rod of the points passes at right angles to the plunger. The blade is bevelled at b^1 as shown, and this acts upon the cross motion *f*—as seen clearer in the drawing, Fig. 6—lying in the recess e^2 in the casting. To the cross motion is attached at f^1 the rod d^3 leading to the detector box.

The safety spring seen, with its cover removed, in Fig. 2, deserves some mention, and details thereof are therefore given in Fig. 7. It is provided by the Great Western Railway to obviate damage to the switches and to the point mechanism when points are run through trailing from the direction for which they are not set. The rod to the points—*c* in Fig. 5—is in two parts. The part nearer the switches ends in blade A and that nearer the motor in blade B. In the end of each blade are two cotters, and between each pair of cotters is a spiral spring. The spring is sufficiently rigid that when blade B is moved it will carry blade A with it, but sufficiently elastic to yield to such undue pressure that would come from blade A being forced in or pulled out, as would happen when the points were run through. After the pressure had passed the spring would return the switches to their former position. The blades are slotted so that, if compressed, they may dovetail. A pressure of 5 cwt. is necessary to compress the spring 9 in.

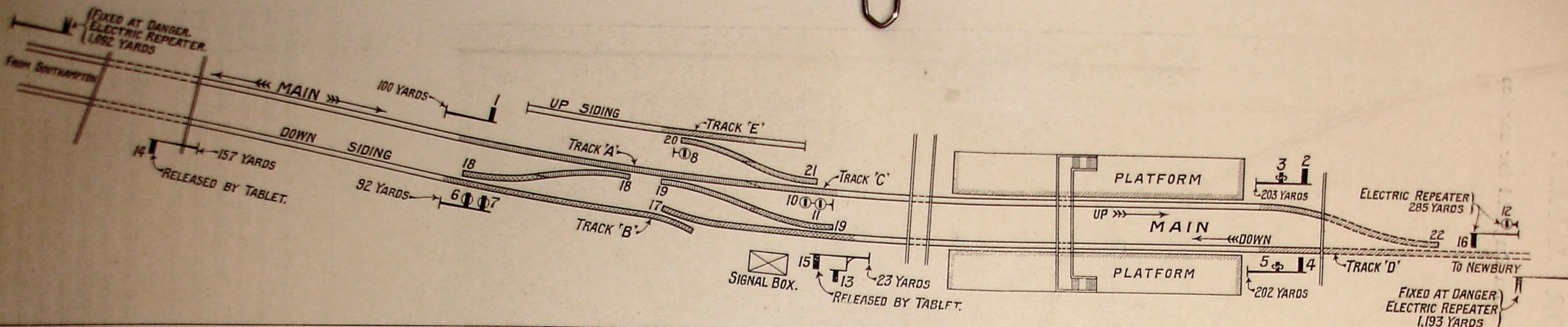
The system has been invented and patented by Mr. L. M. G. Ferreira, Assoc.M.Inst.C.E., chief of the railway signal department of Siemens Bros. & Co., Caxton House, S.W.1, and Mr. R. J. Insell, Chief Assistant to the Signal and Telegraph Engineer, Great Western Railway. We are, as already said, indebted to Siemens Bros. for the drawing from which Fig. 5 has been prepared. For the remainder, and for the opportunity to inspect the work, we have to thank Mr. A. T. Blackall, M.Inst.C.E., Signal and Telegraph Engineer, Great Western Railway.

RAIL RECLAMATION IN THE UNITED STATES.

Recognising that rail wear takes place more rapidly at the ends and necessitating renewal long before the main portion of the rail shows signs of wear, the Illinois Central Railway have introduced the practice of cutting off the damaged ends and relaying the rails, which are then in good condition.

According to our American contemporary, the *Engineering News-Record*, two plants for cropping and drilling rails battered or worn at the ends are operated by the railway, one of which is portable. The permanent plant is situated at Centralia, Ill., and is equipped with electrically-driven machinery. Some 22 men are employed, giving an average output of 10,000 ft. of rail drilled and sawn per eight-hour day. The portable plant is moved from point to point where worn rails are stacked when relaying is to take place in the same district, thus avoiding long haul of the rails to the permanent plant.

A standard crop of 12 or 18 in. at each end is adopted, and rails from a particular track—and therefore of uniform wear—are kept together to facilitate matching of joints when relaying.



			Electrical Control.					Mechanical Locking.		
Nos.	Description.	Route.	Sets points normal.	Sets points reverse.	Restores points normal.	Front locked in R by Track.	Back locked in T by Track.	Nos.	"Normal" Position.	"Track" Position.
1	Home	Up Main	18, 19, 20, 21	—	—	A. C.	(A.C. W 2 in S) (2 in S)	1	7, 8, 9, 10, 11, 12, 14, 15	3, 4, 5, 6, 16
2	Starting	Up Main	—	22	—	D.	D.	2	3, 4, 5, 9, 12, 16	6, 10, 11
3	Shunt	Up Main	—	22	—	D.	D.	3	2, 4, 5, 9, 16	1, 6, 10, 11, 12
4	Starting	Down to Up Main	22	—	—	D.	D.	4	2, 3, 5, 9, 12, 16	1, 7, 8, 13, 15
5	Shunt	Down to Up Main	22	—	—	D.	D.	5	2, 3, 4, 9, 12, 16	1, 7, 8, 13, 15
6	Starting	Siding to Down Main	18, 19	17	17	B. (A.W. 18 or 19 R)	B.	6	7, 9, 10, 13, 15, 16	1, 2, 3, 8, 12
7	Starting	Siding to Up Main	19, 20, 21	18	18	A. B. C.	A. B. C.	7	1, 6, 8, 9, 11, 12, 13, 15	4, 5, 10, 16
8	Shunt	Siding to Up Main	—	20, 21	20	(C. E. W. 20, 21 N)	C. E.	8	1, 7, 9, 10, 12	4, 5, 6, 11, 16
9	King lever	Stands in route position	Free to be pulled to S position to release point slides Nos. 17, 18, 19, 20, 21, 22 for emergency working. Free to be pushed to N position to release route levers from T to N position in case of failure					9	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16	—
10	Shunt	Up Main to Siding	19, 20, 21	18	18	A. B. C.	A. B. C. (12 in S)	10	1, 6, 8, 9, 11, 13, 15	2, 3, 7, 16
11	Shunt	Up Main to Siding	—	20, 21	20	(C. E. W. 20, 21 N)	C. E. (12 in S)	11	1, 7, 9, 10	2, 3, 8
12	Backing	Down to Up Main	—	22	—	D.	D.	12	1, 2, 4, 5, 7, 8, 9, 16	3, 6
13	Starting	Down Main to Siding	18,19	17	17	B. (A.W. 18, 19 R)	B. (16 in S)	13	6, 7, 9, 10, 15	4, 5, 16
14	Advanced starting	Down Main	—	—	—	—	—	14	1, 9	—
15	Starting	Down Main	17, 18	19, 21	—	A. B. (C.W. 21 N)	A. B. (16 in S)	15	1, 6, 7, 9, 10, 13	4, 5
16	Home	Down Main	22	—	—	D.	D.	16	2, 3, 4, 5, 6, 9, 12	1, 7, 8, 10

Levers Nos. 14 and 15 locked by tablet from Southern Railway.

W. signifies "When." N. signifies "Normal." R. signifies "Reversed" T. signifies "Track" position. S. signifies "Signal" position.

Fig. 1.—Lay-out of Signalling and Locking List, Winchester (Cheesehill).