weight c. If the wire should break, the counter-weight would restore the arm to the horizontal (stop) position, and thus prevent the unauthorized passage of a train; and in case of failure of the rod I, the iron spectacle *s* would act as a safety­counter-weight. The back-wire *b* is added to ensure quick movement of the arm, but is not common in England. Long lines of rigid connexions are “compensated” for expansion and contraction due to changes in temperature by the introduction of bell-cranks or rocker-arms. With wire connexions compen­sation is difficult, and many plans have been tried. The most satisfactory devices are those in which the connexion, in the cabin, between the wire and the lever is broken when the signal is in the horizontal position. The wire is kept taut by a weight or spring, and at each new movement the lever (if the wire has lengthened or shortened) grips it at a new place.

So early as 1846 it became a common practice in England to concentrate the levers for working the points and signals of a station in one or more cabins, and the necessity of interlocking soon became evident to prevent simul­taneous signals being given over conflicting routes, or for a route not yet prepared to receive the train. In large terminals concentration and interlocking are essential to rapid movements of trains and economical use of ground.

Fig. 5 shows a typical arrangement of interlocked signals, the principle being the same whether a yard has one set of points or a hundred. The signals (at *a, b,* and *c)* are of the semaphore pattern. For the four signals and one pair of points there are, in the second storey of the cabin C, five levers. Each signal arm stands normally in the horizontal position, indicating stop. To permit a train to pass from A to B the signalman moves the arm of signal *b* to an inclined position (60 degrees to 75 degrees down­wards); and the interlocking of the levers prevents this move­ment unless it can safely be made. If *a* has been changed to permit a movement from S to B, or if the points *x* have been set for such a movement, or if either signal on post *c* has been lowered, the lever for *b* is immovable. In like manner, to incline the arm of signal *a* for a movement from S to B it is first necessary to have the points set for track S, and to have the levers of all the other signals in the normal (stop) position. A sixth lever, suitably interlocked, works a lock bar, which engages with the head rod of the points; it is connected to the lock through the “ detector bar,” *d.* This bar, lying alongside of and close to the rail, must move upwards when the points lock is being moved either to lock or to unlock; and being made of such a length that it is never entirely free of the wheels of any car or engine standing or moving over it, it is held down by the flanges, and the signalman is prevented from inadvertently changing the points when a train is passing. At *r* is a throw-off or derailing switch (“ catch­points ”). When *x* is set for the passage of trains on the main line, r, connected to the same lever, is open; so that if a car, left on the side track unattended, should be accidentally moved from its position, it could not run foul of the main track.

The function of the interlocking machine is to prevent the simultaneous display of conflicting signals, or the display of a signal over points that are not set accordingly. The most common forms of interlocking have the locking bars arranged in a horizontal plane; but for ease of description we may take one having them arranged vertically, the principle being the same. The diagram (fig. 6) shows a section with a side view of one lever. A machine consists of as many levers, placed side by side, as there are points and signals to be moved, though in some cases two pairs of points are moved simultaneously by a single lever, and two or more separate arms on the same post may be so arranged that either one of them will be moved by the same lever, the position of the point connexions being made to govern the selection of the arm to be moved. A switch rod would be connected to this lever at H; the lever K is for use where a signal is con­nected by two wires, as before described. The lever is held in each of its two positions by the catch rod V, which en­gages with notches in the segment B. When the signalman, preparatory to lowering a signal, grasps the lever at its upper end, he moves this rod upwards, and in so doing actuates the interlocking, through the tappet N, attached at T. Lifting the tappet locks all levers which need to be locked to make it safe to move this one. In pulling over the lever the rocker

R is also pulled; but the slot in it is radial to the centre on which the lever turns, so that during the stroke N remains motionless. On the completion of the stroke and the dropping of V, N is raised still farther, and this unlocks such levers as should be unlocked after this lever is pulled (“cleared” or “reversed”). It will be seen that whenever the tappet N of any lever is locked in the position shown in the figure, it is impossible to raise V, and therefore impossible to move the lever.

The action of tappet N may be understood by reference to fig. 7. A tappet, say 3, slides vertically in a planed recess in the locking plate, being held in place by strips G and K. Transverse