

IN THE HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Before Mr. JUSTICE MORTON

(sitting with Dr. D. M. Robinson, Assessor).*

5 November 1st, 2nd, 3rd, 4th, 7th, 9th, 10th, 11th, 14th, 15th, 16th, 17th, 18th,
21st, 22nd, 23rd, 24th, 25th, 29th, 30th, December 1st, 2nd, 5th, 6th, 7th,
8th, 9th, 12th, 13th, 14th, 15th, 16th, 19th, 20th, 21st, 1938; January 11th,
12th, 13th, and February 1st and 27th, 1939.

GENERAL RAILWAY SIGNAL CO., LD.

v.

10 WESTINGHOUSE BRAKE AND SIGNAL CO., LD.,

and

IN THE MATTER OF AN APPLICATION TO AMEND LETTERS PATENT 268,822.

*Patent—Action for infringement—Motion to amend under Section 22 heard
with action—Further application during trial for amendment—Statements under
15 R.S.C. Order LIII (A), rule 21 (A)—Novelty—Subject-matter—Ambiguity—
No evidence by Defendants—Construction of Specification—Monopoly claimed by
Claim 1 not defined by result—Common knowledge abroad and here—Doctrine
of equivalents—Claims 1 and 2 held invalid and not infringed—Claim 3 by agree-
ment treated in consequence as invalid for the purpose of this action—Action
20 dismissed—Certain minor amendments of Specification only allowed—Costs—
Three Counsel—Higher Scale—Particulars of Objections to remaining Claims
—Minutes of Order.*

*Letters Patent, No. 268,822, were granted for "Improvements relating to
"Signalling and Power Operated Switch Systems for Railways." This action
25 having been commenced, the Plaintiffs applied for leave to amend the Specifica-
tion and the application was heard with the trial of the action. The Specifica-
tion ended with fourteen claims and infringement had been alleged of a number
of them; but, as a result largely of the delivery of Statements, the allegation
was reduced to Claims 1 and 2 and the alleged instances of infringement con-
30 sidered were reduced from four to one. Claim 1, including unopposed amend-*

* From the 9th day of the trial onwards.

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ments was as follows:—" 1. A system for the remote operation of railway points
" or switches having power operated switch machines in which for each remotely
" operated switch manually controlled means at a control office are arranged to
" control the operation of a relay adjacent the switch over a single line wire
" and a return wire (or an earth return) said relay controlling the switch machine 5
" and the signals governing traffic over the switch and being interlocked with
" such signals whereby a manually initiated operation of the switch machine is
" prevented if traffic conditions are adverse to such operation." Claim 2 was as
follows:—" The combination of a railway switch, a power operated switch
" machine controlled from a distant control office by a relay adjacent the switch 10
" for operating said switch and signals governing the traffic over the switch
" which are controlled automatically in accordance with traffic conditions and
" by said relay, the control of the relay being such that the signals may be
" operated from the control office to give indications not more favourable than
" actual traffic conditions." Claim 3 was proposed to be amended to make it 15
appendant to Claims 1 and 2, and by agreement between the parties this Claim
stood or fell with Claims 1 and 2.

The Plaintiffs applied by motion to amend Claim 2 by the substitution therefor
of the following:—" 2. The combination of a railway switch, a stretch of track
" which includes the switch, a power operated switch machine, two or more 20
" signals under combined automatic control and manual control from a remote
" control office which are situated at one end of the stretch of track for governing
" traffic over the switch in one direction and are interlocked by means of line
" circuits with one or more opposing signals also under automatic control and
" under independent manual control which is or are situated at the other end 25
" of the stretch of track for governing traffic over the switch in the other direc-
" tion, a relay adjacent the switch controlling the switch machine and the signals
" governing traffic over the switch, manual means at the remote control office for
" actuating the relay, means whereby the control exercised by the
" relay is limited automatically in accordance with traffic conditions, the 30
" combination being such that (1) notwithstanding the operation of the manual
" means at the remote control office for actuating the relay, the operation of
" the switch is prevented if traffic conditions are adverse to such operation;
" (2) the signals may be operated to give indications not more favourable than is
" warranted by traffic conditions." Certain amendments in the body of the 35
Specification were also applied for, many of these were of a minor character and
were allowed. The principal amendments refused are sufficiently referred to in
the Judgment.

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There was also a proposed amendment, by way of disclaimer, applied for at the trial, to be inserted immediately before the Claims; but this was subsequently withdrawn by consent (see the Judgment).

Held, that applications for amendments should not be treated as a separate
5 issue when heard on evidence at the trial and that the Court has power to admit further amendments without advertisement of them.

Held further, that the Specification of the Patent, in the particular example described, of two-way traffic on a single line, disclosed an invention (evidence as to degree of invention was received from American witnesses), but that
10 Claims 1 and 2 were not limited to that case, and included one-way traffic.

Further held, that on a point of construction, the signals referred to in these Claims were those close to the switch and did not include those at the other end of the single track; also that Claim 1 was not by reason of the word "whereby" a claim by result, but that that word referred to the interlock.

15 Held also, the words "adverse traffic conditions" were ambiguous, as was the nature of the interlock proposed; that these Claims failed for ambiguity, and Claim 2 was also anticipated and invalid, by claiming more than the invention disclosed.

Held further, that the Defendants did not infringe these Claims.

20 Claim 3 was also held to be invalid, the Plaintiffs not contending to the contrary.

The power to order Statements under R.S.C. Order LIII (A), Rule 21A should be exercised with caution, but the Statements had been of value in this case.

25 Certain amendments of the Specification, being mainly of a formal and minor nature, were allowed.

The action was dismissed with costs; the costs of the motion to amend to be treated as costs in the action.

Costs were allowed for three Counsel and on the higher scale.

30 *No-Fume, Ltd. v. Frank Pitchford & Co., Ltd.*, 52 R.P.C. 28 and 231, held not applicable.

Natural Colour Kinematograph Co., Ltd. v. Bioschemes, Ltd., 32 R.P.C. 256, at page 269, lines 9 to 13, Judgment of Lord Parker followed.

35 The opening speech of Counsel for the Plaintiffs (summarised below p. 333) comprised descriptions of the apparatus of the Plaintiffs and that of the Defendants.

In view of the complication of the matter the following description of the apparatus and contentions is inserted before the rest of the report, the summary of the speeches being thereby reduced.

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The Plaintiffs alleged that their Specification, for the first time, in spite of a long demand, disclosed a signalling system in which the safety precautions, interlocking, were removed from the signal box to the neighbourhood of the switch, and for the first time enabled switches and signals to be operated from a distance of more than about one mile.

The Defendants contended that a Patent of *Bushnell* had disclosed the same principles, that the Claims of the Plaintiffs' Specification, as worded, included *Bushnell* and even the older type of interlocking, and that as regards infringement the Defendants' system was distinguishable in many respects. Ambiguity, anticipation, and want of subject-matter were also alleged by the Defendants.

Interlocking, Interlocking Frames.—In the usual system of signalling the levers in the signal box are interlocked by *mechanical* arrangements which prevent their movement if traffic conditions are unfavourable. For instance, a switch lever cannot be moved unless the signals are at danger. The mechanical interlocking is supplemented by electrical or *detector* locking by which the presence of trains, position of signals, switches, etc., is electrically transmitted back to the signal box and locks the appropriate signals, etc. In *Power Frames* the actual operation of the switches and signals is by electrical (sometimes pneumatic) means, and purely mechanical interlocking is insufficient, since the signal, etc., may not have followed the lever (as it must do with mechanical rodding). In power-operated systems detector locking is therefore a necessity. In the Plaintiffs' and Defendants' systems the interlocking of levers in the signal box was substituted (as will appear hereafter) by electrical arrangements "in the field," at the switch location. The precise meaning of "interlocking" in these circumstances was in issue. At the date of the Patent in suit a previous Patent, No. 11804 of 1914, had disclosed a system known as the A.P.B. (absolute permissive block); this was in use in America. The A.P.B. dealt with single line railways, at intervals there were passing sidings, and the signalling system (entirely automatic, electrical) was arranged so that if a train entered a single track section, the "*opposing*" signals (that is those admitting a train in the opposite direction) all went to danger, this was called the "*knock down*" arrangement. Neither the signals nor the *switches* or points were under control from a signal box, the train crew had to descend to operate the switches at passing sidings and this they did usually by written *train orders*, sometimes by telephone orders at wayside booths. The A.P.B. system not only put opposing signals to danger, but put the signals behind, in rear of a train, to danger, caution, clear (three positions) successively in the usual manner of automatic signals, so that a following train would proceed, and thus two following trains might be in the same single track section but not two opposing trains. In the A.P.B. system there is no signal box with levers which could be interlocked in the usual manner. At junctions, terminals and similar places, signal boxes with the usual interlocking arrangements were used, but between these points (perhaps 50 or 100 miles apart) safety depended on the "*knock down*" and traffic control upon the train orders. The train control system is inflexible since, once orders are issued, the dispatcher cannot alter the movement of a train at all readily.

Although the complete electrical circuits are complicated, the elements used in all signal and switch operation are comparatively simple. The principal elements are *relays* (an electric bell is a vibrating relay); the ordinary relay when its coils are energised pulls up its armature (the bell hammer) and completes a second electrical circuit, which in its turn may operate other relays, signals, switches. The armature may be arranged to complete one circuit when it is pulled up ("*front contact*") and another when it drops ("*back contact*"). There may be several front and back contacts completing a number of independent circuits, by the operation of the one relay. A *polar relay* is operated by a reversible current and has three positions, positive, negative, neutral. A *stick relay* has a subsidiary circuit ("*stick circuit*") brought through its coils and a front contact, so that once energised by the main ("*pick up*") circuit, it remains energised, till released by some other means.

A *track relay* is arranged so that when a train enters a particular section of track, the relay is de-energised and this may put signals to danger, prevent operation of a switch, etc., etc., and vice versa.

A *control relay* is a relay arranged so that its front (or back) contacts complete a circuit for operating some element, for instance, the motor of a *switch machine* which operates a switch. [There was an issue between the parties as to the exact meaning, in the Specification, of such words as "control," "operate," "permit operation."]

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A *switch* is the arrangement at a junction of two lines, more often called "points" in this country. Usually the *normal* or *N* position is that for straight through traffic and the *reverse* or *R* position for the branch or siding.

A *circuit controller*, or *breaker* is an arrangement, often mechanical, attached to a signal, or a railway switch (points), or operated manually, etc., etc., in order to make or break or reverse an electric current in a circuit. A *point detector* is a form of the above attached to a railway switch and usually arranged to keep the signals at danger till the switch is home, or to select the signals indicating the alternative routes over the switch. (An ordinary electric switch is a circuit controller, but the word switch is used in American practice for railway points. It will be noted that a relay can perform the functions of a circuit controller or electric switch.)

There was an issue as to the meaning of the phrase "if Traffic Conditions are adverse to such operation" in the Specification. Both parties admitted that in railway systems generally certain conditions were important. A switch must not be operated if a train is in the *fouling section*, that is the section of track including the switch. A switch must not be operated unless all the signals giving immediate access to it are at stop. A switch must not be operated if a train is approaching at speed, i.e., under a clear signal, this is called *approach lock*, the Defendants denied that this is necessary in all the layouts contemplated by the Specification. There are traffic conditions applicable also to signals, for example, that opposing trains must not be invited on to a single track, nor two trains allowed to converge at a switch.

Approach lock is usually arranged so that if a train is invited (by signal) to approach a switch, and the signal is then put to danger, the signalman cannot move the switch until after a time delay, sufficient to enable the train to stop (or have overrun the switch).

Claim 4 of the Specification was alleged by the Defendants to relate to a form of approach lock independent of the signals and, if so, that upon the evidence, the inclusion of this feature in Claim 1 (if so construed) robbed the latter of subject-matter.

Line circuits, *line wires* are electric wires running alongside the track and connecting two elements, for instance, two telephones, home and distant signals, signal-box-lever and switch.

One of the issues in the proceedings was whether the Plaintiffs' Patent, which described an arrangement of two line wires (or a single wire and common return or earth) with a three position (polar) relay, was limited to this arrangement, or whether it included an arrangement of two simple relays, necessitating three line wires, or whether the last-mentioned arrangement was a mechanical or electrical equivalent.

The Patent in suit was a division of a U.S.A. convention application, the divided out portion, Patent No. 256,682, dealt with the application of manual control superimposed upon the automatic control of the signals of (for instance) the A.P.B. system. The Patent in suit applied manual control to both the signals and the switches of such a system, and one of the issues in the action was whether the Specification and claims included one-way traffic (and was therefore anticipated) or was limited to traffic running both ways over a switch as in single line working (e.g., A.P.B.).

In the body of the Specification there were but few passages indicating or describing the invention *per se*, but a complete system was described incorporating the A.P.B. system as altered and extended by the invention. The complete system may be summarised as follows:—The A.P.B. system, as already stated, dealt with a single line, with passing loops, and only controlled the signals, the passing of trains and operation of the switches being managed by the train crews under train orders. Such a system might extend over 50 or 100 miles between main stations where there were signal boxes. The Specification described this system with the addition of signal boxes or control towers at intervals along the single line. The towers were connected by (electric) line wires to each passing siding and switch location and the operator in a tower might thus control a number of switches, and the traffic over many miles of line.

The more important elements of the control for each switch are as follows:—In the tower, a *control lever CC.*, having three positions, *N* (for normal position of switch), *R* (for reverse) and neutral. The *N* and *R* positions also put the appropriate signals to clear, while the neutral position puts all signals at the switch to danger, without moving the switch.

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The lever CC is always free to move and one issue was whether the Claims included cases where it is not so free (as in the usual signal box) the claims then being anticipated.

CC is connected to the switch location by a single line wire and return (or common). Adjacent the switch is a polar relay ZFe which follows the positions of CC and effects the operations mentioned. The switch machine SM and thus the switch 208 is operated by ZFe through the intermediary of normal and reverse relays NR, RR and a control relay CR. The relay CR, through its pickup, or input, circuit, collects information as to "traffic conditions," e.g., the position of signals, and delays operation of the switch until conditions are proper. In the case of approach lock (a train approaching the switch) a subsidiary relay CR¹, comes into effect and allows operation of the switch after a time delay.

The signals are operated by ZFe, but, subject to the position of contacts on the switch machine, and others connected with track relays and other signals; these additional contacts in the signal circuits provide for safety by taking account of the position of the switch, of trains and of other signals.

In particular the signals for normal or reverse (of the switch) are selected by the switch machine contacts, but in the arrangement shown the left to right (*Eastbound*) or right to left (*Westbound*) traffic is not selected by ZFe. The latter object, that is the setting up of a direction of traffic on the single line, is effected by an interlock of the signals at one switch with those at the next switch (controlled by ZG^w) by means of circuit controllers on the signals and line wires.

An issue in this action was whether the Claims included this interlock and independent control, together with the stretch of single line between the switches, and excluded an arrangement by which traffic travelled only in one direction (the passing sidings then being loop lines for overtaking only).

A part of the system, which was not alleged to be infringed, is the "O.S." signalling, namely, the arrangements for informing the signalman of events at the switch. Any change at the latter, for example, a movement of a switch or passage of a train, causes a momentary break in the line circuit (CC—ZFe) which rings a bell in the signal box. The spacing, etc., of the taps on the bell distinguish the different kinds of information.

Summing up the general features of the example of the system described, the basis is the A.P.B. system, providing automatic control of the signals for a single line with passing sidings, and upon this is superimposed manual control, from a control point, of the switches (the intermediate signals, on the single line, being entirely automatic, except so far as a manual operation of a signal at a switch may be followed by automatic action, e.g., of a distant signal).

The key to the system as illustrated in the example is the relay ZFe adjacent the switch, which is operated from CC in the signal box and thereafter automatically sets the switch, the signals and the time release, subject to inhibitions in accordance with traffic conditions. If the latter, from being unfavourable, become favourable (e.g., by movement of a train) the desired operation takes place without further action by the signalman.

The Defendants' system.—The following symbols are among those most frequently referred to:—JR, time element (to release approach lock); RP, repeater relay; ALS, approach lock relay; TR, track relay; PR or RP, repeater relay; HR, signal home, i.e., control, relay; GP, signal proving relay (to test if signal at danger, and if so, allow some operation, e.g., of a switch); KR, point detector (to prove that the switch is home, and then allow signal to operate).

The symbols are used in combination, for example, 7N KRP equals switch 7, normal position, detector, repeater. 8A, ALS equals signal 8A, approach lock.

6XS, 6YS, 7XS, 7YS are referred to in detail hereafter.

The Defendants' system consisted of an arrangement of levers in a signal box, the levers were not interlocked with one another (in this respect resembling the Plaintiffs'), but separate levers were provided for the switch and signals. There was no direct connection between the levers and the switch or signals, but the levers actuated a code-setting apparatus which prepared and transmitted a code consisting of combinations of the letters X, Y, Z, by means of three line units and line wires. These three wires, in an eight-letter code as used did not serve merely one switch location or station but anything up to 81; and gave separate service at each to the switch, the signals and the time release (for approach lock).

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At each switch station there was a similar coding apparatus which returned "O.S." information, over the same three wires, as to the condition of affairs. This information was recorded by apparatus in the box and was continuously indicated by a lamp, not merely at the instant of change.

- 5 Assuming the full 81 stations there are nine *field line units* which pick up the code and transmit it to their respective nine *field coding units*, each serving nine *field storage units*.

The first step or letter of the code is for testing the lines; on the second and third steps a particular field line unit is selected, the other eight dropping out; on the 5th, 6th and 7th steps the time (approach lock) element, the switch, and the signal messages are retained by stick relays; and by the 4th and 8th steps the particular *field storage unit* associated with the desired switch is brought in.

The 8th step both performs the desired final selection and hands on the messages (which have been retained in the coding unit) to the storage unit.

- 15 Finally the storage unit completes the operative circuits for switch, signals, etc.

The Plaintiffs alleged that, in serving a particular switch, the code system is an equivalent of their two wire system.

The relays in the Defendants' system which were most discussed were 6X, 6Y (relays in the field coding unit, transmitting on the 6th step, switch normal and reverse messages), 20 7X, 7Y (signals for left-hand and right-hand traffic. A third neutral or Z position puts the signals to danger).

The corresponding relays in the storage unit (i.e., specific to a particular switch) are 6XS, 6YS, 7XS, 7YS.

- 25 It was at first alleged that 6X, 6Y, 6XS, 6YS were equivalent to the Plaintiffs' ZF^e, but at the trial only 6XS, 6YS were relied on, it being asserted that the two relays constituted a single combination relay, or were an equivalent of a single relay.

6XS, 6YS have contacts for operating the switch, but also certain contacts C₃ which are included in the circuit of the relays - - - *HR* which operate the signals. The Plaintiffs alleged that by these contacts 6XS, 6YS control the signals as well as the switches, thus resembling the Plaintiffs' ZF^e, whereas the Defendants maintained that the C₃ 30 contacts are merely a safety precaution designed to prevent a momentary *blink* of the signal lights when reversing the switch, the real control being exercised by 7XS, 7YS.

The Plaintiffs similarly contended that when the switch is operated by 6XS, 6YS, the point detector relays - - - *KR* indicate when the switch is home, and since *KR* contacts are also brought into the signal circuit, 6XS, 6YS thus control the signals. The 35 Defendants' answer was similar, that *KR* is a safety precaution, not an operative control, and corresponds not to any part of ZF^e but to the switch machine contacts of the Plaintiffs.

At the trial the Plaintiffs relied on a single switch No. 7 and the track and signals connected with it, a diagram is included in this report. Briefly there are two terminal 40 platforms at Stanmore, the starting signals for No. 1 Platform are 8LA (through traffic) and 4LA (shunting); similarly for No. 2 Platform, 8LB, 4LB. The lines from Nos. 1 and 2 converge at switch 7 on to the up line, and a short distance out there is a signal 4R for allowing trains to shunt back.

- 45 Switch 7, 8LA, 8LB are controlled from the same storage unit, but signal 4R is controlled from another storage unit (belonging to a switch 3 leading to a siding).

The signals 8LA, 8LB, 4LA, 4LB for outward (right to left, "Westbound") traffic were interlocked with 4R for inward traffic.

- The Plaintiffs alleged that this arrangement corresponded with their signals 2 and 2d 50 (operated by ZF^e) and signal 7 at the next switch (operated by ZG^w).

The Defendants said that the Claims only covered the signals 1, 1s, 2, 2d immediately adjacent the (ZF^e) switch, and that these four opposing signals were not interlocked.

As already observed, in the Plaintiffs' arrangement the safety arrangements, the interlock to prevent operation of the switch, are applied through a relay CR, interrupting 55 the output circuit of ZF^e. The Defendants said that they had nothing to correspond with this; in their system the safety arrangements are interposed between the field coding unit and the field storage unit, so that the code does not reach 6XS, 6YS at all, and must be sent again by a fresh operation.

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Letters Patent No. 268,822, dated the 6th of August, 1925, were granted to *General Railway Signal Company* (of U.S.A.) (of whom the Plaintiffs were the assignees) for Improvements relating to Signalling and Power operated Switch Systems for Railways.

The Complete Specification (with amendments agreed upon before or during the trial shown in italics) (so far as is necessary for the purposes of this report) was as follows:—

“ This invention relates to signalling and power operated switch systems for railways and has for its object to provide for the combined automatic and manual control from a remote point of railway switches and the signals governing the traffic over the switches. 10

“ Various specific objects of the invention, functions, advantages, and characteristics will in part be apparent as the description progresses and will in part be pointed out. In order to illustrate and explain the nature of the invention a single typical arrangement or organization for single track railroads embodying the various features of the invention will now be described and in considering the following description and explanation it should be borne in mind that the various means and operations specifically described are of generic application and adaptable to other conditions occurring in railroad practice. 15

“ In describing the invention reference will be made to the accompanying drawings in which Fig. 1 shows in a simplified and diagrammatic manner a portion of a single track railroad organized and equipped with apparatus embodying the invention, Fig. 2 illustrates more in detail a portion of the track shown in Fig. 1 between two passing sidings and some of the control circuits for the signals, Figs. 3^A and 3^B taken together, illustrate in detail the control circuits and apparatus for the signals and switch operating mechanism at one end of one of the sidings F in Fig. 1 and Figs. 4, 5, 6 and 7 show the control circuits for various individual devices or equipment illustrated in Figs. 3^A and 3^B, these circuits being segregated in this way to facilitate explanation and understanding of the wiring connections and operation. 20 25 30

“ While as already pointed out, the principles and specific apparatus of this invention are adaptable to various arrangements of track on both single and double track railroads, for simplicity and convenience of description and explanation, it is assumed that the invention is applied to a portion of a single track railroad having a relatively simple and typical arrangement of passing sidings, such as diagrammatically shown in Fig. 1. In this case, referring to Fig. 1, the portion of single track railroad is separated in the usual way into stretches or portions of single track M, N, O and P between passing sidings or meeting points D, E, F, G, and H. The movement of trains over the stretches of single track, and into and out of the passing sidings, is handled by track-way signals, both automatically operated by the trains themselves, and also manually by dispatchers or block-operators located at selected intervals. In the specific case shown, it is assumed that a block operator will have supervision or control over three passing sidings and the two intervening stretches of single track, although it is obvious that this zone of control may be extended as far as desired. In Fig. 1 are shown towers 10 and 11 at which the block operators are located to handle train movements over the portion of track shown, together with an additional stretch of single track and a passing siding to the right of the siding H but not shown. At each end of each passing 35 40 45

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- “siding is a like unit of control apparatus and circuits, which is connected by one line circuit (a single line wire and a common), ~~connected~~ to a control and indicating equipment in the tower of the block operator having control over ~~that the~~ corresponding siding. As diagrammatically shown in Fig. 1, the control
- 5 “and the indication equipment at each end of the passing sidings are illustrated by squares designated ZD^w, ZD^e (siding D west and each ends) ZE^w and ZE^e etc., and the control and indication units at the towers are similarly shown by squares designated CD^w, CD^e, CE^w, and CE^e etc. The particular devices and control circuits in these equipments will be hereinafter explained in detail.
- 10 “It is assumed, that an automatic block signal system for single track railroads of the well-known type, commonly known as absolute-permissive-block system, or an A.P.B. system, will be used; and the devices and circuits necessary for a system embodying the features of this invention have been shown in the form adaptable for use with such an A.P.B. system. Accord-
- 15 “ingly, wayside signals are shown conventionally in Fig. 1 and are arranged in accordance with an A.P.B. system, semaphore signals being assumed although of course any other suitable type of signal, such as the colour light, or position light signal may be used. The arrangement of signals is assumed to be the same at each siding and for each stretch of single track between the sidings,
- 20 “and referring to the sidings E and F and the stretch of single track N, there is a starting or absolute stop-and-stay signal 2 at the siding E governing train movement from the main track on to the stretch of single track N, and a corresponding or like starting signal 7 at the siding F. On the siding E is a signal 2^a, ordinarily taking the form of a dwarf signal but which must be
- 25 “obeyed in the same way as a starting signal, which controls train movement from the siding on to the stretch of single track N; and a similar dwarf signal 7^a is provided for the other siding F. The stretch of single track N is provided with intermediate signals in accordance with common practice. In this case, opposite intermediate signals as distinguished from staggered intermediate
- 30 “signals are assumed to be employed, and the signals 4 and 6 govern traffic from left to right, conveniently designated east bound traffic, while the signals 3 and 5 govern west bound traffic. Adjacent to the siding E and governing traffic from the stretch of single track in toward the siding, is an automatic signal 1 and a take-siding signal S, and a similar signal 8 and a take-siding
- 35 “signal are provided for the siding F.
- “A typical A.P.B. system in its complete form is shown and described in detail in the Specification of English Patent No. 11,804/1914, and the modifications of such a system to suit the various conditions met with in a system of the type described herein to illustrate the present invention are shown and
- 40 “described in the Specification of Application No. 19,506 filed 6th August, 1926 (Serial 256,642), of which this is a division; detailed consideration of such systems is therefore not included herein.
- “In order however, that a complete understanding of the system described to illustrate the features of the present invention may be obtained the automatic
- 45 “control of signals by traffic conditions in accordance with a typical A.P.B. system and the modifications in such a system by the introduction of manual control of certain of the signals as described in Application No. 19,506 filed 6th August, 1926 (Serial 256,642), will be considered briefly.

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" Referring therefore to Figs 1 and 2 a stretch of main track is divided into track sections as shown conventionally, each having a track relay, there being ordinarily two track relays between each signal governing traffic in one direction and the next adjacent opposing signal governing traffic in the opposite direction. In Fig. 2, these track relays are shown conventionally as dash lines 5 connected to the track rails. At each end of each siding is a track circuit, bonded to the rails of the siding at the fouling point, in accordance with well-known practice. Each of the signals is controlled by a line relay, in this case of the neutral-polar or polarised type, to provide for the usual three indications. Each starting signal, such as 2, and its corresponding dwarf starting 10 signal such as 2^d, is controlled by one line relay such as H². The control circuits for these line relays are shown diagrammatically in part in Fig. 2, and it will be observed that the line or home relay of each signal includes front contacts of all of the track relays between it and the next signal in advance governing traffic in the same direction, and also, with the exception of the 15 signals 1, 3, 6 and 8, includes a front contact of a neutral armature of the line relay of the signal next in advance governing traffic in the same direction, in multiple with the front contact if the stick relay associated with said signal next in advance. More specifically, the line or home relay H² of the signals 2 and 2^d is normally energized by a circuit including contacts 29, 31 and 32 of 20 the track relays 25, 30 and 19 and a neutral contact 32^a of the polarised home relay H¹. The stick relay just mentioned is controlled, as fully explained in the prior patent above mentioned so that it is energized by a train passing the corresponding signal in the direction of traffic governed thereby but not 25 by a train moving in the opposite direction, and is maintained energized so long as its line or home relay is de-energized or so long as the signal in question remains at stop.

" On account of this method of control of the line relays of the signals, when an east bound train passes beyond signal 2, or signal 2^d, all the opposing 30 signals governing west bound traffic, namely signals 1, 3, 5, 7 and 7^d, are automatically caused to assume or remain in the stop position blocking opposing train movement, until successively passed by the east bound train in question. As this east bound train advances, the signals governing traffic 35 in the same direction, namely signals 2, 4, 6 and 8, automatically assume in succession their stop, caution and clear positions, as with double track signalling. Thus, a train entering the stretch of single track between two passing sidings, from either end, blocks all opposing moves, but permits other trains to follow it under the protection of signal indications the same as with double track signalling.

" In addition to the signal operations just described it is expedient to discuss 40 the control of the two signals adjacent to a passing siding and governing traffic towards it, such as the signals 1 and 3, and 6 and 8. The control circuit for the home relay H¹ governing signal 1 is shown in part in Fig. 2, and more completely in Figs. 3^a and 3^b. It will be observed that this control circuit 45 includes the front contact 15 of the track relay 25, the contacts 112 and 113 of the two track relays 23 and 24 of the track sections between signals 8 and 2 of meeting point F, the contact 114 of the track relay 33 of the track section beyond and in the rear of the signal 8 at the west end of siding F, and that the polarity of the current flowing in the circuit depends on the position of the

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“ polechanger contacts 115 operated by the signal 7. If the stick relay SR’
 “ associated with the signal 7 in Fig. 3^A is energized by a west bound train
 “ movement the circuit of the line relay H’ is dependent only upon the track
 “ circuits between the signal 1 and signal 7 of the same siding F. By virtue
 5 “ of this control, signal 1 is caused to assume a stop position when an opposing
 “ east bound train enters the first track circuit in the rear of the opposing
 “ permissive signal 8, but assumes its stop position for west bound train move-
 “ ments only so long as there is a train between it and the next signal 7 govern-
 “ ing west bound traffic. Putting it another way, the signal 1 has an overlap
 10 “ beyond the next west bound signal 7 of the same siding for opposing train
 “ movements, and this overlap is automatically eliminated for following train
 “ movements. The signal 8 has the same control as signal 1, and this control
 “ for signals 1 and 8 provides an overlap for these signals for trains moving
 “ towards each other, this control and operation being characteristic of the
 15 “ A.P.B. system and being fully explained in the prior patent above mentioned,
 “ does not require further detailed explanation.

“ Referring now to the control for the signal 3, the line circuit for its home
 “ relay H³, shown in part in Fig. 2 and more in detail in Figs. 3^A and 3^B, includes
 “ front contacts 117 and 118 of track relays 19 and 30 of the track sections
 20 “ between said signal 3 and the signal 1 the contact 119 of the relay 25, two
 “ circuit controllers 16 and 17 in series operated by signal 2 and signal 2^d, these
 “ circuit controllers being closed at the stop position only, and pole changing
 “ contacts of a relay PS. The energizing circuit for the relay PS includes a
 “ circuit controller 12 operated by the signal 1, open if the signal 1 is in the
 25 “ stop position, but closed in the clear or caution position, and a front contact
 “ 13 of the line relay H’ of the signal 7 shunted by a front contact 14 of the
 “ stick relay SR’ of the same signal. Thus the line relay H³ of the signal 3 is
 “ de-energized if there is a train travelling in either direction on any one of the
 “ track sections between the signals 3 and 2, or if either the signal 2 or the
 30 “ signal 2^d is in the caution or clear position. Also, the line relay H³ is energized
 “ with reverse polarity, causing its signal 3 to assume the caution position, if the
 “ signal 1 next in advance is in the stop position, or if an opposing east bound
 “ train has entered the stretch of single track N and has de-energized the line
 “ relay H’ (see Fig. 2). In short referring to Fig. 1, an east bound train enter-
 35 “ ing the stretch of single track N not only brings to stop the west bound starting
 “ signals 7 and 7^d, the signal 1 next in the rear that is toward the east thereof
 “ to caution, but also brings the next signal 3 to the caution position, giving
 “ what is commonly known as the double caution indication. For west bound
 “ train movements, however, the caution indication of the signal 3 is dependent
 40 “ upon the signal 1 next in advance being in the stop position. The control for
 “ the line relay H³ of the signal 3 just described is the same as in the typical
 “ A.P.B. system described in the prior patent above mentioned, with the excep-
 “ tion that the circuit controllers 16 and 17 on the starting signal 2 and the dwarf
 “ signal 2^d, and the circuit controllers 21 and 20 on the starting signal 7 and
 45 “ dwarf signal 7^d are included in the energizing circuit for the home relays H³ and
 “ H⁶ respectively.

“ The modifications of such a system introduced in accordance with Applica-
 “ tion No. 19,506 filed 6th August, 1926 (Serial 256,642), are such that briefly
 “ stated, the block operator in tower 10 has manual control in addition to the

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" automatic control afforded by the track relays and train movement, over the
" starting signals, both main and dwarf at the ends of the sidings under his
" supervision. The block operator cannot however, clear any of these starting
" signals or dwarf signals independent of the automatic control by the trains. In
" other words, the block operator may hold the starting signals or dwarf signals 5
" at stop although there are no trains present to necessitate such stop indications,
" but cannot clear these signals unless traffic conditions permit. Also, the block
" operator can select between the main and the dwarf starting signal at the same
" end of the siding and allow one or the other to clear. This control is obtained
" over one polarised line circuit, including a line wire and the common return 10
" wire of the system.

" The block operator also is able to control, over the same control line circuit,
" the indications of the take-siding signals S, displaying or obscuring at will
" a take-siding indication.

" The circuit controllers 16, 17, 21 and 20 previously described, provide a form 15
" of interlock between the signals governing traffic in the opposite direction over
" a stretch of single track, so that the block operator, who may manually cause
" the main starting signal 2 or the dwarf starting signal 2^d to assume or remain
" in the stop position, independent of automatic control by trains, may at will
" select so to speak, the direction of train movement for the stretch of single 20
" track. Since the home or line relay H^s, if de-energized, de-energizes the line
" relay H^s of the signal next in the rear, which in turn de-energizes the line
" relay H^r, it can be readily seen that with either the main starting signal 2 or
" the dwarf starting signal 2^d ~~not in the stop position, as is the case under the~~
" ~~conditions assumed to be normal, and consequently~~ either the circuit con- 25
" troller 17 or 16 open, not only is the signal 3 held in the stop position, but also
" signals 5, 7 and 7^d, blocking west bound train movement in the opposite
" direction.

" It will be evident that the block operator needs accurate and complete
" information with respect to the location of trains and their movement, in order 30
" to be able to determine when to exercise his manual control over the starting
" signals, dwarf signals and take-siding signals. This information, according to
" the embodiment of the invention shown and described is communicated to the
" block operator over the same line circuit by intermittently opening and closing
" this circuit at the siding as conditions require as trains travel through. 35

" Assuming a combined manual and automatic control and also the communi-
" cation of information respecting train movement, it can be readily seen that
" the block operators may co-operate under the supervision of a main dispatcher
" to handle all the ordinary train movements by signal indication only, and
" without issuing train orders. 40

" It has been mentioned heretofore that the block operators may through the
" medium of a single circuit and suitable control mechanism control the signals
" at one end of a passing siding, and may also receive over this same control
" circuit signal information as to the movement of trains commonly known as
" ' O.S. signalling '. The term ' O.S. signalling ' was originally used to denote 45
" the reports made by local station operators to the train dispatcher of the time
" of arrival of trains, and is now generally used to signify the signalling or
" reporting of train movements. Throughout the following description the ' O.S.
" ' signal ' means the signal sent to the dispatcher as a consequence of any

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“ change in the system such as the passage of train, the operation of a switch,
“ etc. Although a large number of control and indicating units of this kind have
“ been conventionally shown in Fig. 1 since these various units are the same,
“ it is considered necessary to describe only one of them, and for this reason the
5 “ control wire for the particular unit herein described (unit CF^e—ZF^e) has been
“ shown in heavy lines in Fig. 1.

“ Referring now to Figs. 3^A and 3^B, circuits and apparatus by which an
“ operator in signal tower 10 can control the operation of the signals and the
“ switch machine at the east end of passing siding F and also receive the corre-
10 “ sponding ‘ OS signals ’ are shown in detail. The Figs. 3^A and 3^B are arranged
“ to be placed end to end so that the whole of siding F is shown together with a
“ small portion of single track sections N and O at each end of the siding. The
“ track is divided up into block sections to which are connected track relays 33,
“ 24, 23, 25, 30, 19 and 31 with their corresponding batteries. Track relays 24
15 “ and 25 are located in the sections adjacent the switches at the west and east
“ end of siding F respectively commonly known as fouling sections and track
“ relays 33 and 30 in the block sections in front of the switch and adjacent the
“ fouling sections which are commonly known as the approach sections. These
“ track relays are associated with various home relays and stick relays to control
20 “ the operation of the signals in a manner similar to that described in Applica-
“ tion No. 19,506 filed 6th August, 1926 (Serial 356,642) and hereinbefore in
“ connection with Fig. 2.

“ At each end of the siding are four signals governing traffic in both direc-
“ tions on the main track and on to and off the siding and referring in particular
25 “ to the east end of the siding signals, 1 and 1^a govern the traffic on to the main
“ track adjacent the siding and the siding respectively, and are both stop-and-
“ stay signals which must not be passed unless one of them is indicating proceed.
“ In this connection it should be noted that the stop-and-stay diverging route
“ signal 1^a and the stop-and-stay signal 1 take the place of the take-siding
30 “ signal S and the permissive stop signal 1 of Figs. 1 and 2 when the switch
“ machine is remotely controlled by the operator in accordance with the present
“ invention. The signals 2 and 2^a govern traffic from the main track and siding
“ respectively on to the single track section O and are again stop-and-stay signals
“ of the same type as 1 and 1^a.

35 “ In order to give suitable indications of the operation of signals 2 and 2^a
“ to the operator in the tower 10 special snubbing contacts may be associated
“ with these signals and employed to open or close a circuit as conditions require,
“ effective only when the semaphore blade is opened in one direction and for
“ convenience a contact functioning in this way has been shown conven-
40 “ tionally. In the particular arrangement shown, a contact 146^d is fastened to
“ but insulated from a contact carrier 122^d and is biased by the spring 123^d
“ against the contact 124^d. The contact carrier 122^d is pivotally mounted on
“ a journal 125^d on which journal is also pivotally supported the arm 126^d
“ urged by the spring 127^d against the contact carrier 122^d. This arm 126^d has
45 “ a roller 128^d pivotally secured in the bifurcated end thereof, which roller is
“ engaged by the projecting cam 129^d of the disc 130^d operated by the semaphore
“ signal blade of signal 2^a. A similar mechanism controlling contact 146 is, as
“ shown, arranged to be operated by the disc 130 associated with signal 2. By

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" looking at the mechanism for operating the contact 146^d it readily appears
 " that when the drum or disc 130^d is rotated in a clockwise direction the con-
 " tact 146^d is operated to the dotted position to complete a circuit at its front
 " contact, whereas if this disc 130^d is rotated in an anti-clockwise direction the
 " cam 129^d merely operates the arm 126^d separately from the contact sup- 5
 " porting member 122^d, such free movement of the arm 126^d being permitted
 " by reason of the spring 127^d. The direction of rotation of the discs 130 and
 " 130^d is arranged so that the contacts 146 and 146^d are operated when the
 " signals 2 and 2^a respectively move towards danger; that is the discs are
 " rotated in a clockwise direction when their respective signals move towards 10
 " the danger position.

" The apparatus CF^e located at the tower 10 corresponding to the east end of
 " siding F includes a battery 48, the circuit controller CC having contact
 " blades 34, 83 and 82, and an operating handle or button 50, an alarm relay 38
 " and a bell 79. 15

" Since the circuit controller CC controls a switch machine SM for operating
 " the switch, and since this switch machine, if operated, will remain in the
 " operated position in spite of the fact that the controller CC is returned to the
 " neutral position it is desirable to indicate into which extreme position the
 " circuit controller CC has last been moved so that this indicator in fact indi- 20
 " cates the position of such switch machine provided the switch machine has
 " been operated as a result of movement of the controller to such extreme
 " position. . . .

" The switch machine SM is one of the usual construction and in the par-
 " ticular arrangement shown includes a direct current motor DM having an 25
 " armature 200, brushes 201 and 202, field winding 203 and a group of contacts
 " operated mechanically when the switch machine motor is operated. . . .

" By reason of the fact that a switch machine is used at each entrance to each
 " of the various sidings of the single track system shown in Fig. 1, the apparatus
 " governing the entrances to a single track section becomes a localized inter- 30
 " locking system, and for this reason the signals as stated hereinbefore governing
 " the entrance to and the departure of trains from, the sidings and main
 " track adjacent thereto must be stop-and-stay signals as indicated by the square
 " ended blades of signals 2, 2^a, 1 and 1^a. The stop-and-stay diverging route
 " signal 1^a must be read in connection with the stop-and-stay 35
 " signal 1 and these two signals must not be passed unless one of them is
 " indicating proceed. This diverging route signal 1^a is a two-position ' zero to
 " ' forty-five degrees position signal ' and is controlled by the fouling track
 " circuit relay 25, the switch machine and the relay ZF^e in a manner more
 " clearly pointed out hereinafter. Also the stop-and-stay signals 2 and 2^a must 40
 " not be passed if at stop in accordance with well established rules of railway
 " practice.

" In order to control the switch machine SM by the relay ZF^e under pre-
 " determined traffic conditions in each direction for a predetermined distance
 " from the switch 208, certain switch machine control relays are required. In 45
 " the particular arrangement shown a normal relay NR, a reverse relay RR, a
 " control relay CR and a supplementary control relay CR¹ are employed.
 " In order to determine the conditions of traffic for a predetermined distance
 " towards the east, that is towards the right in Fig. 3^b, a relay AR has been

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“ provided which in the arrangement shown is controlled by the first three track
“ circuits toward the east of the signal 1. The circuit for energizing this relay
“ may be traced as follows:—Beginning at the terminal B of a suitable source
“ of energy, wire 214, front contact 215 of the track relay 31 shown connected to
5 “ the track section controlled by signal 4, wire 216, front contact 217 of another
“ track relay 19 of section O, wire 218, front contact 219 of the track relay 30
“ of section O, wire 220, winding of the relay AR, wire 221 back to the common
“ return wire C connected to the other side of said source of energy. This
“ circuit also has a multiple branch including wire 212 and front contact 213
10 “ of the stick relay SR⁴. By this arrangement the relay AR is energized when
“ there is an east bound train on the track circuit controlling track relay contact
“ 215. The circuit for the home relay H¹ may be traced as follows:—Beginning
“ at the battery 225, pole changer contact of pole changer switch 115 operated
“ by the signal 7, wires 227 and 228, front contact 114 of the track relay 33,
15 “ wire 231, front contact 113 of the fouling track circuit relay 24, wires 234
“ and 235, front contact 112 of the track relay 23 connected to the track circuit
“ of the main track adjacent to siding F, wire 238, front contact 15 of the fouling
“ track circuit relay 25, wire 241, winding of the home relay H¹ to the common
“ return wire C connected by the pole changer switch 115 to the battery 225 (see
20 “ Fig. 3^A). Since the signal 7 normally assumes its danger position the home
“ relay H¹ is energized negatively and assumes its reverse position as indicated
“ in Fig. 3^B.

“ Further additional apparatus used in the system as shown includes contacts
“ 244, 245, 246, and 247 operated by the semaphore blades of signals 2, 2^d, 1^s
25 “ and 1 respectively. Each of these contacts is closed if the signal with which it
“ is associated is in the danger or stop position.

“ It may be pointed out at this time that the signal 3 assumes its caution
“ position in Fig. 3^B because the home relay H³ is energized negatively. It is not
“ considered necessary to trace this circuit specifically.

30 “ In order to give an audible signal at the tower when the switch machine
“ starts and again when it has completed its stroke a relay SMI is
“ employed. . . .

“ OPERATION.

“ In considering the operation of the system let us first assume a simple case
35 “ in which there is an east bound train on the siding F, and the operator wishes
“ to allow this train to proceed east bound into the stretch of single track O.
“ Since the siding is not track circuited, the presence of this train does not
“ affect the system. Let us further assume that the stretch of single track O is
“ blocked for west bound traffic either because there is an east bound train
40 “ moving in this stretch or because the starting signals at the east end thereof
“ are manually held at stop. In order for the train in question to move off the
“ siding, the operator moves the handle 50 of the circuit controller CC of
“ mechanism CF⁸ in the tower 10 to the lower position, so as to energize the
“ relay ZF⁶ negatively and to cause it to assume the reverse dotted
45 “ position. . . .

“ Under conditions assumed, the control relay CR assumes its energized
“ position, the energizing circuit for which may be traced as follows:—Beginning
“ at the battery 52, wires 261 and 262, front contact 263 of the relay AR, wires
“ 264, 265 and 266, front contact 267 of the home relay H¹, wires 268, 269 and

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" 270, winding of the control relay CR, wires 280 and 281, crank circuit controller 210, wires 282, front contact 283 of the fouling track circuit relay 25, wire 284, contacts 247 and 246 operated by the semaphore signals 1 and 1^s, wire 285, contacts 245 and 244 operated by the semaphore signals 2^d and 2 respectively, wires 286, 287, 158 and 159 to common return wire CC connected 5
" to the other side of the battery 532. This circuit can most readily be traced in Fig. 7 wherein this circuit alone is shown. Having now explained how the control relay CR is energized, and having pointed out how the relay RR is energized in response to negative energization of the relay ZF^e, let us now proceed to trace the circuit for the switch machine which will operate the switch 10
" 208 to the reverse position:—Beginning at the battery 290, wires 291 and 292, front contact 293 of the reverse relay RR, wires 294 and 295, brush 202, armature 200, brush 201, wires 296 and 297, back contact 298 of the normal relay NR, wire 300, contact 209 of the switch machine SM, wires 301 and 302, field winding 203 of the switch machine motor, wires 303 and 304, front 15
" contact 305 of the control relay CR, wires 306 and 307 back to the battery 290. With this circuit energized the switch machine will operate the switch 208 to the reverse position and near the end of this stroke will open the circuit just traced by shifting its contact 209. It should be noted that the armature of the motor DM is normally shunted through the medium of back contacts 357 and 20
" 358 of relays CR and CR' respectively, through a circuit readily traced in Fig. 3^B. This shunting circuit is provided to assure the switch machine against operation by unauthorized current.
" With the switch machine SM in the reverse position and the switch 208 in a position to allow the train on the siding F to move into the stretch of single 25
" track O and with the relay ZF^e energized to a position corresponding to that of the switch machine, a circuit for clearing the dwarf signal 2^d is closed which may be traced as follows:—Beginning at the battery 52, wires 53 and 53^a, front contact 51 of the relay ZF^e, wire 54, polar contact 49 in the reverse dotted position, wires 78¹, 78, wire 308, front contact 83 of the home relay H², polar 30
" contact 92 of the same relay, clearing wire 132, signal mechanism of the dwarf signal 2^d, wire 309, contact 204 of the switch machine SM, wires 310, 311, 312, 313 and 259 to the common return wire C connected to the other side of the battery 52. The completion of this circuit causes the dwarf signal 2^d to assume 35
" the clear position, so that the train on the siding may proceed in the stretch of single track O. Signal 1^s is also cleared at this time but this is of no particular importance because there is no train moving from right to left in the single track section O and no train is permitted to enter this single track section because the dwarf signal 2^d has broken the energizing circuit for the 40
" home relay H², H^s, H' H¹, so that all the best bound signals assume the stop position. Further, if there had been a train in this section the dwarf signals 2^d could not have been cleared, so that there is no real conflict in the signal indications, as a matter of fact, even though both the dwarf signal 2^d and the diverging route signal 1^s are clear at the same time.

" AUDIBLE INDICATION OF SWITCH MACHINE OPERATION. 45

" Let us consider at this time how the operator at tower 10 has been informed as to the response of the switch machine SM to his movement of the circuit controller CC to the lower position. . . .

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" AUDIBLE INDICATION OF TRAIN MOVEMENT OVER THE SWITCH.

" 1. Train moving from siding F on to the single track section O.

" Assume there is a train standing on the siding which is an east bound train
and faces to the right and that in response to the clearing of dwarf signal 2^d the
5 " engineer proceeds to move his train into the stretch of single track O. As soon
" as the train enters upon the fouling track circuit the track relay 25 is de-
" energized thereby opening the circuit for the relay ZF^e and 38.
" This energizing circuit for the relay ZF^e causes this relay ZF^e to vibrate,
" and in turn causes the relay 38 at the tower to vibrate which in turn causes
10 " the clapper of the bell 79 to vibrate. The net result is that the bell 79 is
" vibrated so long as the uni-directional contact 146^d of the dwarf signal breaks
" the normal energizing circuit under the condition assumed. As the train
" moves entirely off the fouling track circuit and the track relay 25 again picks
" up, no sounding of the bell 79 is experienced because the stick relay SR² by
15 " its front contact 99 shunts out the contacts 151 and 153 operated by relays
" 25 and TP respectively.

" 2. Train moving from main track adjacent siding F on to the single track
section O.

" A train moving off the main track adjacent to the siding into the stretch of
20 " single track effects O.S. signalling in substantially the same way as when
" moving off the siding, that is, gives two closely spaced taps and then causes
" vibration of the bell clapper for a period of time. The cam portion 129 is,
" however, preferably a little longer than is the cam portion 129^d, so that the
" time during which bell 79 vibrates when one of these starting signals moves
25 " to the stop position due to the movement of a train is sufficiently different from
" that of the other, for the operator to know which of these signals has moved
" to danger.

" 3. Train moving from single track section O on to siding F.

" Assume that there is a train in section O moving from right to left and that
30 " the switch machine is in the reverse position so that signal 1^a is set for the
" approaching train to move on to the siding. It should be noted that under
" these conditions signals 2 and 2^d at siding F are at danger and relay H² is
" de-energized as west bound traffic must have been set up in section O when
" either signal 7 or signal 7^d of siding G was cleared to allow the west bound
35 " train to enter section O. . . .

" The net result is that a train moving from right to left into the main track
" or siding at a meeting point causes the bell to give two spaced taps spaced
" about a second apart and when the train enters the siding and causes it to
" sound another two taps which are spaced only about a half a second apart
40 " when it has passed wholly within the siding limits.

" 4. Train moving from single track section O on to the main track adjacent
the siding F.

" When a west bound train in section O approaches siding F, the switch
" having been set for the main track and signal 1 cleared the O.S. signalling
45 " as the train enters the main track adjacent the siding is exactly the same as
" that just described, namely two taps of the bell spaced about a second apart
" are given, when the train enters the fouling track circuit and two closely
" spaced taps are given when it passes completely off this track circuit. It

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" should be pointed out that the operator is able to tell whether the train has
 " taken the siding or the main track by the letter (N or R) displayed by his
 " controller CC which indicates as heretofore described, the position of the switch
 " points.

" APPROACH LOCKING.

5

" From the circuit for the control relay CR heretofore traced it is apparent
 " that all of the signals at the east entrance to the siding F must be at stop and
 " the home relay H¹ or the stick relay SR¹ as well as the relay AR or the stick
 " relay SR² must be up in order that the energizing circuit for the control relay
 " CR may be completed (see Figs. 3^B and 7). In this connection it should be 10
 " noted that the front contact 267 of the home relay H¹ may be shunted by the
 " contact 288 of the stick relay SR¹ and that the front contact 263 of the relay
 " AR may be shunted by the wire 190 and front contact 289 of the stick
 " relay SR², so that the approach locking is effective only to approaching trains.
 " In other words, if a train is moving in the section controlled by home relay H¹ 15
 " in a direction away from the switch 208 the stick relay SR¹ will be up and the
 " home relay H¹ need not be energized; also, if a train is moving in the section
 " controlling relay AR in a direction away from the switch 208 in which event
 " the stick relay SR² is held up, this relay AR need not be energized; so that
 " the net result is that the relays H¹, SR¹, AR and SR² complete the energizing 20
 " circuit for the control relay CR if there are no trains approaching the switch 208
 " within distance considered dangerous in each direction from this switch. It
 " may be stated at this time that the stick relay SR¹ is controlled in exactly the
 " same way for west bound traffic passing the signals 1 or 1^s, by these signals
 " and associated apparatus as the stick relay SR² is controlled by east bound 25
 " traffic moving by the signal 2 or 2¹ and similar associated apparatus, this
 " stick relay SR¹ not being used at all in the usual A.P.B. signalling systems.
 " The pick-up and stick circuits for this relay SR¹ have not been shown
 " specifically, but the stick contact 224 has been illustrated.

" Once the relay CR has been energized, as previously explained, it is main- 30
 " tained energized, independently of the presence of trains adjacent the switch,
 " so long as all four of the signals 2, 2¹, 1 and 1^s remain at stop, due to a stick
 " circuit which may be traced as follows: Referring to Figs. 3^B and 7, beginning
 " at the battery 52 wires 261, 314, 315 and 321, front contact 322 of relay CR,
 " wires 323 and 270, winding of relay CR, wires 280 and 281, crank circuit 35
 " controller 210, wire 282, front contact 283 of fouling track circuit relay 25,
 " wire 284, circuit controllers 247 and 246 of signals 1 and 1^s, wire 285 and
 " circuit controllers 245 and 244 of signals 2 and 2^s and wires 286, 287, 158, 159,
 " common return wire C and 260 to the other terminal of the battery. Hence,
 " the approach locking is not effective if train movement over the switch is 40
 " blocked in both directions before trains come within the approach locking
 " limits, these trains receiving signal indications to bring them to a stop; and so
 " long as the signals remain at stop, the switch may be operated to either
 " position even though trains have subsequently moved up to the switch. When-
 " ever one of the signals is clear to allow train movement over the switch, how- 45
 " ever, a train approaching the switch from either direction within the limits of
 " a control for the home relay H¹ and the relay ~~CR~~ AR will prevent any subse-
 " quent operation of the switch machine.

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“ SWITCH MACHINE STICK CHARACTERISTIC.

“ It should, however, be noted that the circuit for the control relay CR need
“ not be completed after the switch machine has once been started on its
“ operating stroke, for as soon as this occurs a stick circuit for the control
5 “ relay CR is completed which may be traced as follows: . . . The net result
“ is, if the control relay CR has once been energized and the switch machine
“ has started on its operating stroke a distance to close contact 207, as a result
“ of the energization of one or the other of relays RR and NR, the switch
“ machine will remain energized until it has completed its stroke even though a
10 “ train moves within the limits mentioned.

“ To explain a further feature of the operation, assume that there is an east
“ bound train on the main track adjacent siding F at the time the switch was
“ reversed, as above explained, and that the east bound train on the siding has
“ passed over the switch and into the stretch of single track O. With a train on
15 “ this main track the track relay 23 (see Fig. 3^A) assumes its de-energized posi-
“ tion and by reason of dropping of its front contact 112, de-energizes the home
“ relay H¹.

“ Let us now assume that the operator at tower 10 wishes to allow this train
“ on the main track to enter the stretch of single track O, and in order to do so he
20 “ moves the controller CC to the upper position and thereby displays the
“ letter N and applies positive energy to the relay ZF^e thus energizing this
“ relay ZF^e to its normal position. With the relay ZF^e energized positively an
“ energizing circuit for the normal relay NR is completed which may be traced
“ as follows:—

25 “ Beginning at battery 52, wires 53 and 53^a, front contact 51 of the relay ZF^e,
“ wire 54, polar contact 49 of this same relay assuming its normal position, wires
“ 55¹, 328, back contact 329 of the reverse relay RR, wire 330, winding of the
“ normal relay NR, wires 331 and 259 to the common return wire C connected
“ to the other side of battery 52 by wire 260.

30 “ The energization of the normal relay NR will not, however, apply energy
“ to the switch machine SM because the control relay CR is not up. This control
“ relay CR is not energized at this time because the approach locking is effec-
“ tive, this because the home relay H¹ is de-energized and the stick relay SR¹
“ which has a front contact 288 in multiple with the front contact 267 of the
35 “ relay H¹ is also not energized, this because the train standing on the main
“ track parallel to siding F is headed eastward and has not picked up this stick
“ relay SR¹ so that the control relay CR remains de-energized. Also, although
“ the east bound train previously considered as being on the siding has energized
“ the stick relay SR in moving off the siding, this does not change the condi-
40 “ tion so far as the energization of the relay CR is concerned, because the
“ front contact 289 of this stick relay SR shunts the front contact 263 of the
“ relay AR and leaves the front contact of the relay H¹ unshunted.

“ AUTOMATIC TIME ELEMENT RELEASE.

45 “ The approach locking features as thus far described, which have been
“ provided to guard against the throwing of a switch in front of a fast moving
“ train, would consequently lock such switch against movement under condi-
“ tions which commonly occur in practice unless supplemental unlocking means

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" is provided. The safety of the supplemental unlocking means, namely the supplemental control relay CR¹, is based on the premise that it is safe to operate the switch machine if the fouling track circuit containing track relay 25 is not occupied and the signals at such switch have been at danger for a period of time sufficient to either stop a train or which train if it is not stopped has already passed by such switch or is occupying the fouling track circuit.

" With the control relay CR de-energized for reasons heretofore given, and with the relay ZF^a, and the normal relay NR energized, a circuit for energizing the supplemental release control relay CR¹ is completed which may be traced as follows:—Beginning at the battery 52, wires 261, 314, 334 and 335, front contact 336 of the relay NR, wires 337, winding of the supplemental control relay CR¹, wire 338, back contact 339 of the control relay CR, wires 340 and 281, crank circuit controller 210, wire 282, front contact 283 of the fouling track circuit relay 25, wire 284, contacts 247 and 246 operated by signal blades of signals 1 and 1^a respectively, wire 285, contacts 245 and 244 operated by signal blades of signals 2ⁿ and 2 respectively, wires 286, 287, 158 and 159 to common return wire C connected to the other side of battery 52 by wire 260.

" This supplemental control relay CR¹ is one of the retarded type, and may be retarded by any suitable means, such as clock mechanism, a dash-pot, a mercury contact delayed in completing a circuit on the hour glass principle, or the like, and for convenience a dash-pot 342 has been shown conventionally for this purpose.

" After an interval of time deemed sufficient to allow a train moving at high speed to have passed the switch 208 if it already occupied the section controlling the home relay H¹ or the relay AR depending on the direction of movement of the train, or during which time if the engineer of the train has acted upon the signal indication must have brought his train to a stop before it reached the switch 208, or if he did not act thereon probably has passed the switch, and which time may for convenience be assumed to be about two minutes, the front contact 343 of this retarded or slow acting supplemental control relay CR¹ is closed. With this contact 343 closed and the relay NR up, the switch machine is energized by a circuit in which the flow of the current through the armature is in the opposite direction from that which flowed in the circuit heretofore traced for this machine with the relay RR up, but current in the field winding is in the same direction as before, so that the torque and rotation of the motor is reversed. This circuit comprises battery 290, wires 291 and 344, contact 298 of the relay NR in its raised position, wires 297 and 296, brush 201, armature 200, brush 202 of the switch machine motor, wires 295 and 294, contact 293 of the reverse relay RR in its lower position, wire 345, contact 209 of the switch machine, wires 346 and 302, field winding 203 of the switch machine motor, wires 303 and 347, front contact 343 of the supplemental control relay CR¹, wires 348 and 307 back to the battery 290.

" With this circuit completed, the switch machine SM is again returned to its normal position, and with the train in the main track adjacent to siding F holding the home relay H¹ in its retracted position and with the relay ZF^a energized positively, a circuit for energizing the starting signal 2 is completed;

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" whereas no circuit for the signal 1 is completed because the home relay H¹ is in its de-energized position. The energizing circuit for the signal 2 may be traced as follows:—Beginning at the battery 52, wires 53 and 53^a, front contact 51 of the relay ZF^e, wire 54, polar contact 49 in its normal position, wires 55¹, 55 and 55^a, front contact 56 of the home relay H², polar contact 57 of this same relay, clearing wire 58 of the signal 2, the signal control mechanism of signal 2, wire 349, contact 204, of the switch machine in its normal position, wires 350, 312, 313, 259, common return wire C connected to the other side of a battery 52. With the starting signal 2 in its clear position which is only possible if the switch 208 is set for the main track the train in question may proceed into the stretch of single track O in accordance with the signal indication afforded by the usual A.P.B. signal apparatus.

" It should be noted that if the train just mentioned had not yet entered the main track adjacent to siding F, and had been back a distance beyond the track circuit controlling track relay 33 that the control relay CR would have assumed its energized position, and the time delay necessitated by the use of the supplemental control relay CR¹ would have been avoided; this because the home relay H¹ would have assumed its energized position under this condition. Further, if a train had just backed off siding F and for this reason the switch at the west end of siding F had been open at the time it was desired to operate the switch machine SM the switch box contact 60¹ would have been closed in which event the home relay H¹ would have been energized even though track relays 24 and 33 were de-energized.

" Further, if such train had been a west bound train which passed either the signal 7 or the signal 7^a, and in so doing picked up the stick relay SR¹, the front contact 116 of this stick relay would have been up to maintain the relay H¹ energized.

" The switch box contact 60¹ and stick relay contact 116 are provided to shunt the contacts 114 and 113 of track relays 33 and 24, mainly for the reason that under the conditions of traffic when one or the other or both of these contacts are closed it is safe to have the signal at least indicate caution.

" When this switch machine has moved the switch 208 to the reverse position, that is to a position so that the train may take the siding, and with the relay ZF^e energized a circuit for energizing the diverging route signal 1^a is completed which may be traced as follows:—Beginning at the battery 52, wires 53 and 53^a, front contact 51 of the relay ZF^e, wire 54, polar contact 49 in the reverse dotted position, wires 78¹, 78 and 352, front contact 353 of the fouling track circuit relay 25, wire 354, mechanism of the 45 degrees diverging route signal 1^a, wire 355, contact 205 of the switch machine SM, wires 356, 311, 312, 313, 259 and common return wire C leading to the other terminal of battery 52. Attention is particularly directed to the fact that none of the signals at a switch, such as 208, can assume a proceed position unless the switch machine controlling it and the control relay, such as ZF^e, are positioned correspondingly or are in step, so to speak; it is by virtue of this fact that all signals will assume the stop position, a necessary requisite to the picking up of the control relay CR, when it is attempted to operate the switch machine by energizing the control relay ZF^e. It should be noted that even though the switch machine is in the reverse position and the control relay ZF^e is in the reverse position, that the

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" dwarf signal 2^d is not clear; this because the home relay H² H² is de-energized
" for the reason that there is a train moving in the stretch of single track O from
" right to left and home relay H² can not be picked up as long as west bound
" traffic is moving in this single track section O on account of the interlocked
" features present in any A.P.B. system as readily understood by those skilled 5
" in the art of absolute-permissive block signalling.

" TRAIN MAKING PASS FROM REAR.

" Let us assume that the train in question in response to the display of the
" stop-and-stay diverging route signal 1^s takes the siding F and finds the starting
" dwarf signal 7^d at the west end of the siding F at stop and is held on this 10
" siding because the operator at tower 10 wishes the next train in the rear, which
" is a superior train, to pass the train on siding F, this other and superior train
" having already entered the stretch of single track O but not having yet reached
" any one of the track circuits controlling the relay AR. Under the assumed
" condition, the operator in tower 10 will move the circuit controller CC to the 15
" raised position thereby displaying the letter N and in turn energizing the
" relay ZF^e to its normal position. With the relay ZF^e energized, the home relay
" H¹ is energized because the siding is not track circuited and the relay AR is
" energized, the normal relay NR and the control relay CR will assume their
" energized positions for reasons heretofore given, thereby causing the switch 20
" to be operated by the switch machine SM to its normal track position. With the
" switch machine assuming its normal position and the relay ZF^e energized to its
" normal position, and with the home relay H² held de-energized because west
" bound direction of movement of trains has been set up in stretch of single
" track O, an energizing circuit for the signal 1, which moves this signal to the 25
" caution position, is completed. This circuit may be traced as follows:—
" Beginning at the battery 52, wires 53 and 53^a, front contact 51 of the relay
" ZF^e, wire 54, polar contact 49 in its normal position, wires 55¹, 55 and 360,
" front contact 361 of home relay H¹, wires 362 and 363, signal mechanism of
" the signal which moves the semaphore blade to the forty-five degree or caution 30
" position, wire 364, contact 205 of the switch machine in its normal position,
" wires 365, 350, 312, 313, 259, common return wire C and wire 260 leading to
" the other side of the battery 52. As the train in question moves from east to
" west in the stretch of single track O and approaches the meeting point F, it
" finds the main signal 1 at caution which informs the engineer that he may take 35
" the main track at meeting point F at a speed ready to stop at the next signal.
" Had the operator desired to allow this second train to move by meeting
" point F at high speed he would have cleared signal 7 located at the west end of
" siding F and in so doing would have caused this signal by reversal of its pole
" changing contact 115 to apply positive energy to the home relay H¹ which in 40
" turn would have caused the signal 1 to assume its clear position. After the
" superior train has entered the stretch of single track N a distance permitting
" the dwarf signal 7^d to assume either the caution or clear position, the negative
" energization of the relay ZF^w (not specifically shown) at the west end of
" siding F by the operator allows the inferior train on the siding to follow the 45
" superior train in the single track N with the usual signal protection.

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" TRAINS MAKING A MEET.

" Let us now assume that there is an east bound train on the main track adjacent siding F and that it is to wait to meet a west bound train in the stretch of single track O. Let us further assume that the switch machine SM is already assuming the reversed position and the relay ZF^e is energized so that
5 " the diverging route signal 1^s is displayed. Although the switch machine and the relay ZF^e are also in a position to display the dwarf signal 2^d this signal is not displayed because the home relay H² is down because west bound traffic is moving in the stretch of single track O or else west bound traffic has been selected for the stretch of single track by the clearing of one or other of the
10 " starting signals at the east end of the stretch of single track O before the relay ZF^e was energized. Since everything is in condition for the west bound train to move into the siding F, let us assume that it does so. During entrance of this train upon the fouling track circuit containing relay 25 a back contact (not shown) of this relay in series with a contact closed between 435 and 90° (not
15 " shown) on signal 1^s completes a pick-up circuit for stick relay SR¹, which relay is then stuck up through the stick contact 224 of this relay SR¹ and a back contact on relay H¹ in series therewith.

" After the train in question has entered the siding F the switch machine SM may immediately be operated to the normal position without the two-minute
20 " delay necessitated by the use of the supplemental control relay CR¹ bearing in mind that relays AR and SR¹ are energized (see Fig. 7). In other words, the relay CR is energized, and as soon as the operator effects energization of the normal relay NR, the switch machine is operated to the normal position, the starting signal 2 is cleared and the train on the main track may proceed into
25 " the stretch of single track O. It should be noted that the train on the main track parallel to siding F, which presumably entered this main track from the west end and in so doing picked up the stick relay for signal 8 (not shown) so that its front contact shunts the front contact of the home relay of signal 8 (not shown) in the energizing circuit of the corresponding control relay CR
30 " (not shown) at the west end of siding F, so that the approach locking for the mechanism at the west end is not effective under the conditions assumed and no further delay in the trains making the meet is experienced. The starting signal 7^d at the west end of siding will of course assume the clear position as soon as the track switch at the west end of siding F is open, assuming of
35 " course that there is no train approaching the single track section N, and under the assumed condition the train on the siding F can immediately proceed westward into single track section N.

" DISTINCTIVE AUDIBLE O.S. SIGNALLING.

" Let us now consider the movements of trains over a single track railway
40 " involving a plurality of sidings as occur in actual practice. In order that the tower men can readily distinguish at which switch location a certain train movement or switch operation takes place, the various bells employed in the towers have distinctive sounds, and for this reason let us assume that the bells at control points CE^e, CF^w and CF^e located at tower 10 have a high,
45 " a medium and a low tone respectively, and that the bells at control points CG^w, CG^e and CH^w located at tower 11 have a high, a medium and a low tone

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" respectively. Let us further assume that each of the switches assume their
 " normal or main track positions and that each of the relays ZE^e, ZF^w and
 " ZF^e, etc., assume their normal de-energized positions, and that there is a west
 " bound train moving in a single track section P and there is an east bound
 " train on the main track at the passing siding E. Under the conditions assumed 5
 " the towermen at towers 10 and 11 will of course know of the presence of these
 " trains and the direction in which they are moving and in accordance with this
 " information will get into telephonic communication with each other, and with
 " the advice of the train dispatcher will decide to allow these trains to meet,
 " say at siding F. 10

" In order to make this meet the towerman at tower 10 places the con-
 " troller CC associated with the control mechanism CE^e and CF^w in a position
 " to energize the corresponding relays positively and will place the controller
 " associated with mechanism CF^e so as to energize the relay ZF^e negatively. 15
 " In response to making these circuit changes he will receive a tap on the high,
 " the medium and the low tone bell in accordance with the operation of these
 " controllers. In addition to these three taps he will receive a double tap
 " on the low tone bell when the switch machine SM of switch 208 at the east
 " end of siding F starts to move to the reverse position and experiences 20
 " another double tap on this low tone bell when this switch has completed its
 " movement. Further, the starting signal 2 located at the east end of the
 " siding E will assume its clear position, as will the signal 8 located at the west
 " end of siding F. Also, after the switch 208 at the east end of siding F has been
 " reversed the dwarf signal 2^d associated therewith will assume its clear posi-
 " tion and diverging route signal 1^s associated therewith will assume its 25
 " or proceed position. The signal 2 at the east end of siding F of course
 " remains at stop so as to hold the east bound train on the main track of
 " meeting point F. The attendant at tower 11 will move the circuit controllers
 " CC associated with mechanism CG^e and CG^w to the upper position so as to
 " energize the relay associated therewith positively in response to which a single 30
 " tap is given on the medium tone and the high tone bell respectively located at
 " tower 11. Movement of the relay ZG^e (not specifically shown) to its normal
 " energized position causes the signal 1 associated therewith to assume the clear
 " position, movement of the relay ZG^w (not specifically shown) to the positive
 " energized position causes the signal 7 associated with the west end of siding 35
 " to remain in its danger position because the dwarf signal 2^d at the east end of
 " siding F is clear, so that, east bound direction of travel has
 " been set up in the stretch of single track O. Since it is desired
 " first to have west bound traffic move over stretch or track O the
 " attendant at tower 10 will momentarily de-energize relay ZF^e. This will put 40
 " the dwarf signal 2^d at the east end of siding F to stop and the starting
 " signal 7 at the west end of siding G will move to clear, which change in this
 " signal 7 in turn causes all of the east bound home relays in the stretch to
 " assume their de-energized position, and since this includes the relay H² shown
 " in Fig. 3^B the dwarf signal 2^d at the same location will remain in its danger 45
 " or stop position even after the relay ZF^e is again energized by the operator.
 " The diverging route signal 1^s at the east end of siding F will however again
 " assume the 45° position.

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- " The system has now been set up to make a meet at siding F and the signals
 " and switches are so positioned that the west bound train must take the siding
 " at meeting point F. As the east bound train at siding E proceeds in accordance
 " with the clear position of signal 2 located at this siding, two closely spaced
 5 " taps of the high tone bell at tower 10 are given as the fouling track circuit
 " relay is dropped and the stick relay associated with signal 2 is picked up; and
 " immediately after these two taps this same bell vibrates for a short time indi-
 " cating that the signal 2 at the east end of siding E has moved to the danger
 " position in response to the passage of the east bound train. As the rear end
 10 " of this train passes off the end of the fouling track circuit at the east end of
 " siding E no sound is given for reasons heretofore pointed out. We may
 " assume that in the meantime, the west bound train running in single track
 " section P has reached the main track at siding G. As this west bound train
 " enters upon the fouling track circuit at the east end of siding G, two taps in
 15 " the medium tone bell at tower 11 are given, which taps are spaced apart about
 " one second due to the fact that the fouling track circuit relay at the east end of
 " siding G has dropped and the repeater track relay TP for this location has
 " dropped after a time. As the rear end of this west bound train moves entirely
 " into the main track adjacent to siding G, and the tail end of this train clears
 20 " this fouling track circuit, two closely spaced taps of this same medium tone
 " bell at tower 11 are given, these taps being due to picking up of this fouling
 " track circuit relay and its associated repeater relay. As this west bound train
 " proceeds into the single track section O two closely spaced taps of the high
 " tone bell in tower 11 are given as the fouling track circuit relay at the west
 25 " end of siding G is de-energized and the stick relay associated with signal 7
 " at this same siding G is picked up. Immediately following these two taps of
 " the high tone bell at tower 11, this same high tone bell vibrates for a time
 " indicating that the signal 7 has moved to the danger position in response to
 " passage of the train into stretch of single track O.
 30 " We may now assume that the east bound train moving in the stretch of
 " single track N is entering the main track adjacent siding F and in so doing
 " gives two taps of the medium tone bell in tower 10 spaced about a second
 " apart upon entering the fouling track circuit at this end of siding F, and when
 " the rear end of this train passes entirely beyond this fouling track circuit
 35 " two closely spaced taps of this same bell are given so that the attendant at
 " tower 10 knows that the east bound train has reached its destination for
 " meeting the west bound train, bearing in mind that signal 2 is at stop, thus
 " holding the east bound train.
 " We may now assume that the west bound train proceeds into the siding in
 40 " response to the display of the diverging route stop-and-stay signal 1^a, located
 " at the east end of siding F. As this west bound train enters the siding F two
 " taps of the low tone bell 79 shown in Fig. 3^A of the drawings are given, spaced
 " about a second apart, this sounding being followed with two more closely
 " spaced taps when the rear end of the west bound train has passed entirely
 45 " into the siding F.
 " As soon as the east bound train passed entirely into the main section parallel
 " to siding F it was proper for the towerman at tower 10 to reverse his controller
 " associated with mechanism CF* thereby putting it in the lower position and
 " energizing the relay ZF* (not specifically shown) to the negative position,

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" and we may assume that he did do this as quickly as possible. With this
 " relay ZF^w energized negatively the supplemental control relay associated
 " therewith is energized and its front contacts close after the period of time
 " heretofore mentioned, after which the switch machine associated with relay
 " ZF^w is operated to its reverse position, so that the west bound train which 5
 " has just been assumed to have taken the siding F may immediately, or after
 " a minimum amount of delay, proceed westwardly into the stretch of single
 " track N. At the same time, the operator at tower 10 may move the circuit
 " controller CC (shown in Fig. 3^A) to the upper position whereby the relay
 " ZF^e assumes its positively energized position, which in turn because the switch 10
 " machine SM and relay ZF^e are out of step causes the signal 1^s to assume the
 " danger position if it has already assumed a proceed position. All of the signals
 " at the east end of siding F are now in the danger position. Movement of the
 " circuit controller CC to the upper position, resulting in positive energization
 " of the relay ZF^e causes the normal relay NR to be energized, and since the 15
 " relays AR, SR¹ and 25 are energized the control relay CR is also energized.
 " the switch machine SM shown in Fig. 3^B is operated to its normal position; the
 " operator at tower 10 being informed of this operation of the switch machine
 " by two very closely spaced taps on the low tone bell when this switch machine 20
 " starts and two more closely spaced taps on this same bell when it has com-
 " pleted its stroke. As soon as the switch machine has returned to its normal
 " position the signal 2 located at the east end of the siding F is cleared and
 " the east bound train may proceed through the stretch of single track O,
 " through the main track parallel to siding G, the stretch of single track P and so 25
 " on, the attendant at tower 11 being informed as to the location of this train
 " as it enters and leaves the various meeting points, and single track sections.
 " Similarly, the west bound train is now free to move through the stretch of
 " single track N, through meeting point E, single stretch of track N etc. the
 " progress of which will be noted by the operator at tower 10 by the audible
 " sounds given by the various bells located in his tower. Various other train 30
 " movements might be discussed, but this is believed unnecessary because the
 " principle of leading a train into the main track or the siding as conditions
 " require and holding it there to allow one or more others to pass has already
 " been quite fully discussed. Also, the audible signals are the same for each
 " individual train movement past a meeting point and for each switch machine 35
 " operation, so that it is deemed unnecessary to consider more fully the operation
 " of the system.

" REVERSING SWITCH MACHINE AT INTERMEDIATE POINT IN STROKE.

" It sometimes happens that when a switch machine is operated it only
 " partially completes its stroke because something such as a lump of coal, or the 40
 " like, gets between the switch points and the main rail, and under this condition,
 " it is preferable to be able to operate the switch back to its original position.
 " Obviously, this can not be done unless special means is provided for shifting
 " the reversing switch drum 209 to the opposite position. The specific feature
 " whereby this may be accomplished has not been shown in Fig. 3^B, but in 45
 " practice comprises two electro-magnets one connected across one pair of brushes
 " co-operating with contact 209 so that the contact drum 209 is shifted when

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“ current is applied to one or the other of wires 300 and 345 at a time and when
 “ this particular wire is not already connected to the field of the switch machine
 “ through the medium of contact 209. In other words, the reversing switch 209
 “ is operated to the opposite position from that which it assumes mechanically by
 5 “ the switch machine when this switch machine completes its stroke, but if this
 “ switch machine does not complete its stroke this contact 209 is not shifted to
 “ the opposite position mechanically, but is shifted electro-magnetically as soon
 “ as energy is applied to the wire for operating this switch machine to such
 “ opposite position. Since the apparatus for accomplishing this function does
 10 “ not form a part of the present invention, this apparatus has not been specifically
 “ illustrated and reference may be had to the Specification of Patent No. 169,795
 “ which shows a specific disclosure of this means for reversing a switch machine
 “ at midstroke. The switch machine shown in Fig. 3^B may be considered to be
 “ the same as that shown in the patent referred to above and for further informa-
 15 “ tion in regard to the crank circuit controller 210 heretofore mentioned and
 “ other parts of the switch machine, reference may be had to this patent.
 “ In this connection it should be noted that the switch machine relay SMI is in
 “ its de-energized position throughout substantially the whole operating stroke of
 “ the switch machine, and that the relay ZF^e may be reversed at any time so
 20 “ long as this relay SMI is in its de-energized position. Further, that reversal
 “ of the relay ZF^e with the control relay CR stuck up by its stick circuit causes
 “ the switch machine SM to be reversed, because the application of potential to
 “ the reversing wire before the machine has completed its previous operating
 “ stroke causes the contact 209 to be reversed by the pole changing magnets
 25 “ disclosed in the above Patent No. 169,795 and causes the switch machine to
 “ be returned to its original position. In this way the switch machine may be
 “ operated back and forth until the obstacle such as a lump of coal, has been
 “ crushed or been displaced in such a way that the switch machine may complete
 “ its stroke. This ability to reverse a switch machine when its mechanism is at
 30 “ an intermediate point in its stroke is considered an essential feature in any
 “ circuit arrangement for controlling a switch machine for the reasons above
 “ given, so that the arrangement shown in Fig. 3^B affords the same control over
 “ the switch machine, with respect to reversal of the machine at an intermediate
 “ point in its stroke, commonly afforded in interlocking systems and like systems
 35 “ employing power-operated means for operating track switches.

“ SUMMARY.

“ It may be of interest to note that the control relay CR assumes its energized
 “ position whenever all of the signals located adjacent the switch machine con-
 “ trolled by this relay CR are in the danger position, in spite of the fact that there
 40 “ is a train approaching within the distance or limits in which track circuits
 “ control the relays AR and H², providing none of these signals have indicated
 “ proceed since a train has entered these limits; this being true because the partial
 “ circuit leading from the control relay CR to the battery 52, and including the
 “ front stick contact 322 of this relay CR, is in multiple with a circuit including
 45 “ front contacts of these relays and permits energization of this relay CR, this
 “ being proper because if these signals are at stop the signal 3 (as shown in
 “ Fig. 3^B) in the stretch of single track O will be at caution and the signal 8
 “ located at the other end of the passing siding F will be at caution, so that the

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"engineers on trains passing these distant signals will have signal indications instructing them to proceed ready to stop within vision.

"Generally speaking, it may be said, that the four signals at the entrance to a single track section will be governed jointly by the direction of traffic set up in the single track section at the entrance to which these signals are located and 5
"by the position of the track switch located at the entrance thereto. In other words, considering the switch 208 at the east end of siding F, if the switch machine is normal and the direction of traffic selected is from west to east the signal 2 only can clear. If however, the direction of traffic selected is from 10
"east to west then the signal 1 only can clear. Assuming now that the switch machine is in its abnormal or reverse position, if the direction of traffic selected is from east to west the diverging route signal 1^s only can assume its proceed position whereas if the direction of traffic selected with the switch machine 15
"reversed is from west to east, then both the dwarf signal 2^d and the diverging route signal 1^s can be cleared, the clearing of this diverging route signal 1^s means nothing however since there can be no train approaching the signal 1^s coming out of the single track section O.

"The approach locking features forming part of the system shown in Figs. 3^A and 3^B have heretofore been discussed on the assumption that the approaching 20
"train is entering the zone in which approach locking is provided with the signal, such as the signals 3 and 8 for instance, indicating clear traffic conditions. It is however, desired to be pointed out that if the approaching train enters this locking zone when the signal, such as signals 3 and 8, is at caution, because the signals 1, 1^s, 2 and 2^d are at stop, this approach locking is not 25
"effective. This phase of the operation is apparent by looking at Fig. 7, in which it readily appears that if the control relay CR is once up, and providing the signals 1, 1^s, 2 and 2^d associated with the particular control relay CR in question have not been moved from the danger position after the train in question has entered such approach locking zone, the relay CR is stuck up by 30
"its stick contact 322. In other words, if the control relay ZF^e is left in its de-energized position on the approach of a train, the switch which is controlled by this control relay ZF^e may be operated without incurring the amount of delay imposed by the use of the control relay CR¹, and will be operated immediately this relay ZF^e is energized to a position to operate the switch machine. This feature of the system adds to the facility of switch operation 35
"and train movements in that the delay or two or three minutes heretofore mentioned need not be imposed even though there is a train approaching on the approach locking zone in the event that this train has accepted a caution or danger signal upon its entrance upon such zone. In considering certain movements of trains in connection with the operation of the various control relays 40
"and the movement of other trains, which movements have not been specifically considered, this feature of the invention should be borne in mind.

"The supplemental control relay CR¹ is made slow acting to safeguard against the sudden operation of the track switch in front of an approaching train 45
"without first giving the engineer of such train signal information restricting his movement of the train; this is, it is proposed that if energy is applied to the various relays for controlling a switch machine, that these relays can not respond unless the signals at such switch indicate danger, and the next signal in each direction governing the movement of trains toward the said switch

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“ are at caution. If there should be a train moving toward the switch at high
“ speed within certain limits heretofore mentioned, the control CR for such
“ switch can not pick up, and the picking up of the supplemental control relay
“ CR¹ is a result of the control relay CR being de-energized, is so much delayed
5 “ that this high speed train will either have passed the switch, will be occupying
“ the fouling track circuit so that relay 25 will be down under which condition
“ the switch machine can not be initiated, or this train will come to a stop before
“ it reached the switch. In practice, the time which should elapse before the front
“ contact 343 of the supplemental control relay CR¹ is closed has been found to be
10 “ about two or three minutes.

“ Having thus shown and described a system in which the safety afforded by
“ the absolute-permissive block signalling system for single track railways is
“ combined with manual supervision over the signals and switches associated
“ with the various sidings, for the purpose of dispatching and directing the
15 “ movement of trains, it is desired to be understood that the various features
“ of the invention may be applied to other types of signal systems as herein-
“ before stated for single and double track working.

“ Having now particularly described and ascertained the nature of our said
“ invention and in what manner the same is to be performed, we declare that
20 “ what we claim is:—

“ 1. A system for the remote operation of railway points or switches having
“ power operated switch machines in which for each remotely operated switch
“ manually controlled means at a control office are arranged to control the
“ operation of a relay adjacent a the switch over a single line wire and a return
25 “ wire (or an earth return) said relay controlling the switch machine and the
“ signals governing traffic over the switch and being interlocked with such
“ signals whereby a manually initiated operation of the switch machine is
“ prevented if traffic conditions are adverse to such operation.

“ 2. The combination of a railway switch, a power operated switch machine
30 “ controlled from a distant control office by a relay adjacent the switch for
“ operating said switch and signals governing the traffic over the switch which
“ are controlled automatically in accordance with traffic conditions and by said
“ relay, the control of the relay being such that the signals may be operated from
“ the control office to give indications not more favourable than actual traffic
35 “ conditions.

~~“ 3. The combination of a railway switch, a power operated machine for
“ operating said switch controlled from a distant control office and in a system
“ according to claim 1 or in a combination according to claim 2 a device actuated
“ by reason of a train approaching said switch within a zone of predetermined
40 “ extent which device prevents operation of the switch machine if a signal at
“ the entrance to the zone is at clear, indicating favourable traffic conditions.~~

“ 4. A system for the remote operation of railway points or switches having
“ power operated switch machines and a relay adjacent a switch adapted to be
“ manually controlled from a remote control office to cause the operation of the
“ switch machine at said switch in which a control relay is arranged to be
45 “ de-energized to open the energizing circuit for the switch machine if there is a
“ train in a track section immediately adjacent said switch (fouling section) or a

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" train approaching the switch in a second section (approach section) extending
" a predetermined distance in advance of said first or fouling section.

" ~~5. A system as claimed in Claim 4 and~~ in which an alternative energizing
" circuit for the control relay is completed if a signal at the entrance to the
" second or approach section ~~does is not indicate favourable traffic conditions at~~ 5
" ~~clear~~ so that the entrance of a train on to the second or approach section under
" such conditions does not prevent a manually controlled operation of the switch
" machine.

" ~~5 6. A system as claimed in Claim 4 or Claim 5~~ in which when the energizing
" circuit of the switch machine has been opened by reason of a train approaching 10
" the switch and within the second or approach section a supplementary control
" relay having a time lag characteristic, is adapted to complete an alternative
" energizing circuit for said switch machine after a predetermined time interval.

" ~~6 7. A system as claimed in Claim 4, or 5~~ in which additional relays
" (SR¹) and SR²) are provided and are arranged to be energized by a train 15
" passing through the fouling section adjacent the switch, energization of said
" relays completing a circuit for the control relay (CR) whereby manual operation
" of the switch machine is not prevented by a train on the approach section
" providing such train is moving in a direction away from the switch.

" ~~7 8. A system as claimed in any one of the preceding claims in which~~ contacts 20
" associated with the switch machine co-operate with the remotely controlled
" relay to transmit code signals to the control office corresponding to an operation
" of the switch machine.

" ~~8 9. A system as claimed in Claim 1 and Claim 6 7~~ in which the code signals
" are transmitted to the control office over the same line wire and return wire as 25
" are used to control the relay, substantially as described.

" ~~9 10. A system as claimed in Claim 7 8 or Claim 8 9~~ in which a code signal
" is transmitted to the control office when the movement of the switch machine
" starts and a second signal when the movement of the switch machine is
" completed substantially as described. 30

" ~~10 11. In a single track railway system having a siding, a plurality of signals~~
" at the entrance to said siding governing the entrance and departure of trains to
" and from said siding and main track adjacent said siding, track relays for
" governing said signals in accordance with traffic conditions, manually con-
" trollable means for holding certain of said signals at stop, a power-operated 35
" switch machine for operating the switch leading to said siding, manually
" controllable means for controlling said switch machine and means for pre-
" venting operation of said switch machine if there is a train approaching within
" a certain limited distance from either direction toward said siding.

" ~~11 12. A single track railway system having a main track and a siding, a~~ 40
" switch and signals for said siding, a power-operated switch machine for
" operating said switch, a relay controlled over a line wire from a remote point
" for controlling said switch machine, and means for preventing the switch
" machine responding to a change in the position of said relay unless all of the
" signals at said siding governing traffic into and out of the single track section 45
" are at stop.

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" 12 12. A single track railway system having a siding, a plurality of signals
" at the entrance to said siding governing the entrance and departure of trains to
" and from said siding and the main track adjacent said siding, a power-
" operated switch machine for operating a switch leading to said siding, a relay
5 " at said siding for controlling said switch machine, control means for manually
" operating said relay from a distant point, said switch machine responding to a
" change in the position of said relay only if there are no trains within certain
" limits of said switch at the time said relay is changed and supplemental means
" for controlling said switch in accordance with the position of said relay effective
10 " only after an interval of delay.

" 13 14. A railway signalling and power-operated switch system substantially
" as described and illustrated with reference to the accompanying drawings."

The layout of the Defendants' tracks at Stanmore terminal is shown herewith.
Wembley lies off the diagram, 4 miles to the left. The portion of the tracks
15 shown in solid lines is that selected by the Plaintiffs to establish infringement.

On the 17th of September, 1935, *General Railway Signal Co., Ltd.*, commenced proceedings against *Westinghouse Brake and Signal Co., Ltd.*, for infringement of the Patent No. 268,822. The Plaintiffs by their Statement of Claim alleged (1) that they were the Registered Legal Owners of Patent
20 No. 268,822; (2) that the Patent was valid and subsisting; (3) that the Defendants had infringed and threatened and intended to infringe. They claimed an injunction and other usual relief. In their Particulars of Breaches the Plaintiffs alleged infringement of Claims 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12 and 13
25 by the installation in 1932 and 1933 of a "C.T.C." installation of signal control between Wembley Park and Stanmore, Middlesex, as described in "The Railway Gazette" of 17th March, 1933.

The Defendants by their Defence (24th December, 1935) as amended (30th March, 1937) and Particulars of Objections (amended) denied infringement, admitted the "C.T.C. installation," alleged that the said Letters Patent
30 were invalid and in the alternative that "their said installation in so far as the same is described and claimed (if at all) in the Plaintiffs' said Letters Patent was not novel at the date of the Plaintiffs' said Letters Patent but was part of (A) the general common knowledge in the art of controlling railway signals and points and/or (B) published knowledge available to the Defendants
35 " and exemplified in the documents and prior users set forth in the said Particulars of Objections." The Particulars of Objections (amended) alleged:
I. Want of novelty by reason of (A) Publication in (1) Letters Patent *Siemens* 10,579/1900; U.S.P. *Zabel* 892,203/1908; *Bushnell* 1,299,295/1919; *Harlow* 1,345,176/1920; *Harlow* 1,373,503/1921; *Whitney* 1,421,880/1922; (only *Bushnell*
40 was ultimately relied on at the trial). (2) A manual, "Alternating Current Signalling," by *McCreedy* "commonly used in this country by Railway Engineers and available to the public" in the Patent Office Library. (3) "Railway Signal Engineer," Vol. 12, No. 1, pp. 7 and 8; Vol. 16, No. 5, pp. 211-213; Vol. 16, No. 6, pp. 253-255. (4) *Union Switch and Signal Company's* Bulletin No. 100. (5) A book "Electric Locking," by *Anderson*.
45 (B) Prior Users (1) Mersey Railway (this was not proceeded with by the

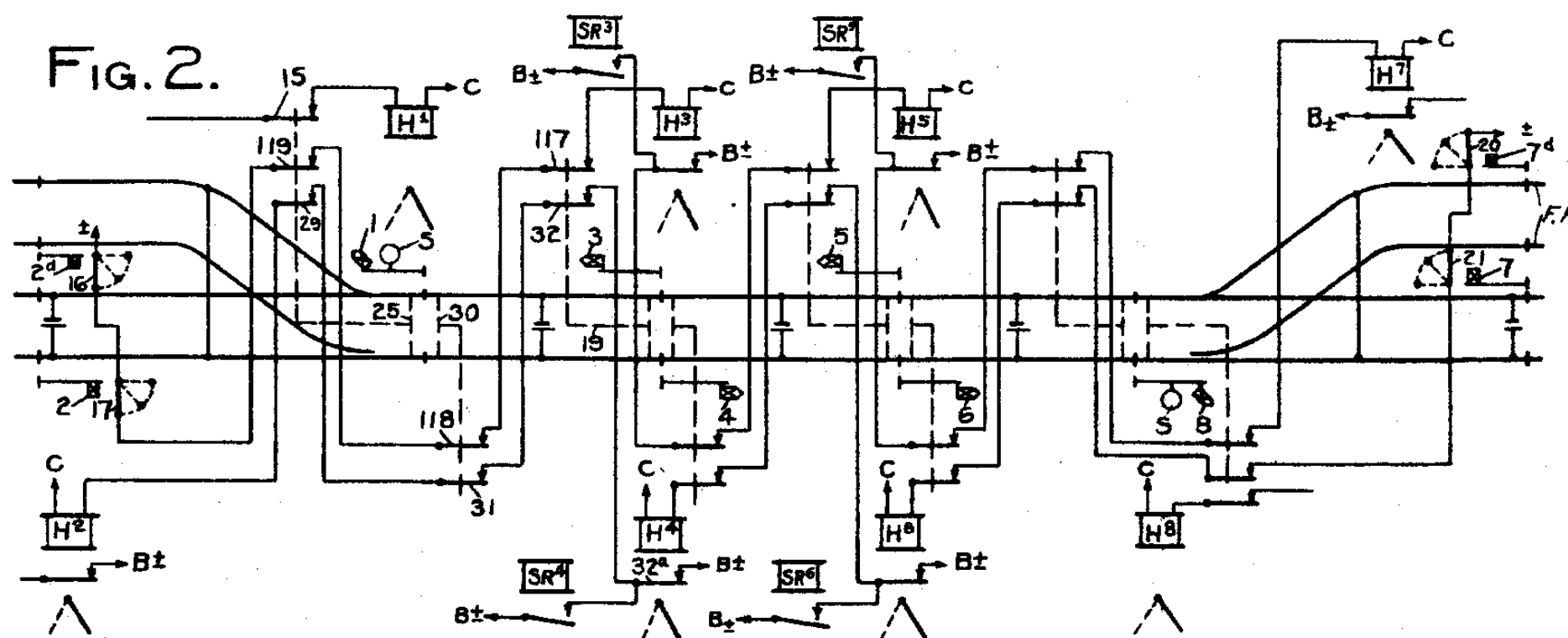
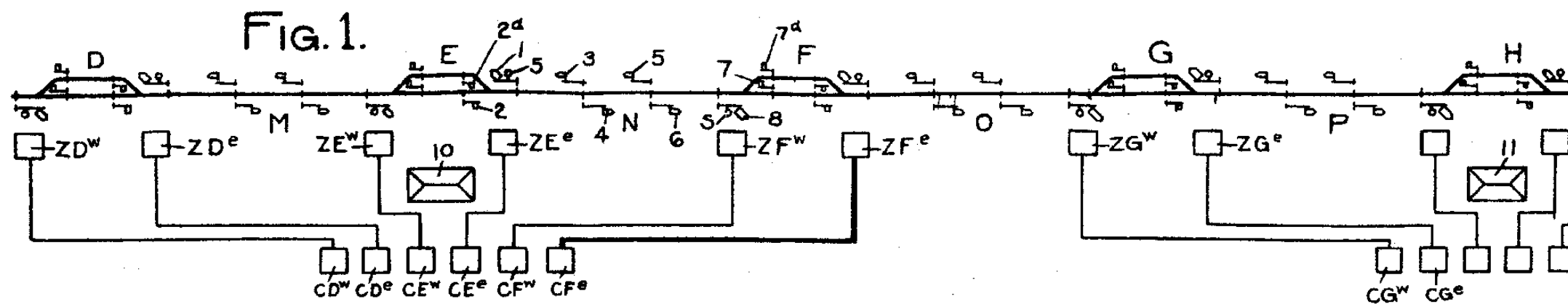
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Defendants at the trial, though referred to by the Plaintiffs). (2) An installation at Ashington Colliery, Northumberland, as described in the "Railway Engineer," June, 1922, Vol. 43, pp. 221-223, and in Bulletin S.3 of the Defendants. II. That the alleged invention was obvious and did not involve any inventive step having regard to (A) general common knowledge in the art of controlling railway signals and points at the date of the said Letters Patent, and (B) the public knowledge existing at the said date and disclosed in the publications, prior users and plans and descriptions relating thereto. III. The Complete Specification was ambiguous and did not sufficiently or clearly ascertain the nature and scope of the monopoly claimed [alleged against Claims 1, 2, 3 and 5 and appendant claims.]

Further particulars were applied for by the Plaintiffs by letter and given concerning the particular parts of *McCready* relied upon.

On the 29th of July, 1936, an order was made under R.S.C. LIIIA, 21 (a), providing *inter alia* for: the admission without proof of printed or photostat copies of specifications; notification by the Defendants within 14 days as to whether they admitted the use of the installation at Stanmore; inspection of the installation by the Plaintiffs; results of experiments, models, drawings, photographs not to be given in evidence unless notice had been given by 15th, November 1936, with opportunity for inspection (the period was extended from time to time by consent); experiments, etc., in reply, notice within one month; enlargement of time by agreement between the parties; liberty to apply. On the 23rd of March, 1937, the Defendants obtained leave to amend their Defence and Particulars of Objections on a "*Moule's Patent Earth Closet*" order, and their amended Pleadings were delivered on the 30th of March, 1937.

On the 22nd of June, 1937, a further Order was made under the revised R.S.C. LIII (A), rule 21 (a), providing:—1. [That the Plaintiffs were to admit (or not) the further documents cited, and printed or photostat copies were to be used.] 2. [Extension of periods mentioned in the previous order.] 3. "(1) That the Plaintiffs do deliver to the Defendants on or before 30th September, 1937, a statement signed by Counsel (a) Specifying the integers and combination of integers alleged to be comprised in each of the claims which the Plaintiffs allege are infringed by the Defendants and exemplifying each of such integers by reference to the drawings and the body of the specification, and (b) Stating in the case of each integer or combination of integers whether the words in the claim denoting the same include every construction which and only such constructions as fall within the said words in their ordinary meaning in the art when read apart from the body of the Specification or whether some and if so what limitation or extension is to be implied therein and in such case stating the reasons for such implication, (c) Specifying and indicating by reference to drawings what are the particular parts or combinations of parts in the Defendants C.T.C. installation of signal control . . . which the Plaintiffs contend infringe the several claims respectively . . . alleged to be infringed . . . The Defendants giving the Plaintiffs all such facilities as they may reasonably require of inspecting the Defendants' installation to enable them to make such drawings. (2) That the Defendants shall on or before 15th November, 1937, deliver to the Plaintiffs a statement signed by Counsel specifying (a) the extent to which the Defendants accept the contentions set forth in the Plaintiffs'



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“ said statement and in so far as the same are not accepted stating the
 “ Defendants’ contentions in respect of the said matters; (b) in respect of each of
 “ the documents alleged to have been published and each of the installations
 “ alleged to have been used prior to the date of the Patent as set forth in
 5 “ paragraph 1 (A) and (B) of the amended Particulars of Objections and relied
 “ on by the Defendants the relevant integers alleged to be disclosed by each of
 “ the same and giving all necessary references to the text and drawings in the
 “ case of the said documents or to the component parts of any installation
 “ relied upon as a prior user; (c) the respects in which it is alleged that the
 10 “ invention was not new and/or was obvious and involved no inventive step
 “ at the date of the Plaintiffs’ said Letters Patent having regard to each of the
 “ matters referred to in paragraphs 1 (a) and (b) and paragraph 2 of the
 “ Amended Particulars of Objections; (d) the respects in which it is alleged
 “ that the Complete Specification . . . is ambiguous and does not sufficiently or
 15 “ clearly ascertain the nature and scope of the monopoly claimed. (3) That
 “ the Plaintiffs may within three weeks from the date of the delivery of the
 “ Defendants’ said Statement deliver to the Defendants a Statement signed
 “ by Counsel specifying any contentions upon which they intend to rely in
 “ rebuttal of the contentions of the Defendants. . . . (4) That no amendment
 20 “ of any of the aforesaid Statements shall be made and that no evidence
 “ shall be adduced in support of any contention which is inconsistent with or
 “ is not included in the Statements referred to . . . except upon application to
 “ the Court or Judge and upon such terms as to costs and otherwise as may be
 “ deemed just.” 4. (Action not to be listed till 14 days after exchange of
 25 Statements.) 5. (Costs, costs in Action.) 6. (Liberty to apply.)

On the 21st of October, 1937, the Plaintiffs’ Statement, on the 11th of January, 1938, the Defendants’ Statement, and on the 7th of April, 1938, the Plaintiffs’ Statement in reply were delivered. On the 25th of March, 1938, after considering the Statements, the Plaintiffs (undertaking to abide by any Orders as to terms
 30 and costs and not in the meantime to threaten Actions for Infringement) by motion obtained leave to apply to amend their Patent Specification, upon oral evidence at the trial.

And the Plaintiffs to “ deliver to the Defendants a supplemental statement
 “ signed by Counsel specifying (1) with respect to each of the amended claims
 35 “ the effect and object of the amendment proposed, (2) by reference to drawings
 “ what are the particular parts or combination of parts in the Defendants C.T.C.
 “ installation . . . which the Plaintiffs allege correspond to the several
 “ integers of each of the claims as proposed to be amended and . . . the
 “ Defendants do deliver to the Plaintiffs within fourteen days of the delivery of
 40 “ the Plaintiffs’ supplemental Statement a Statement . . . in reply . . .
 “ specifying the extent to which they accept the contentions set forth . . .
 “ and in so far as . . . not accepted setting forth the Defendants’ conten-
 “ tions in respect thereof.” [Costs, costs in Motion. Liberty to apply.]

On the 7th of April, 1938, the Plaintiffs’ Supplemental Statement and on the
 45 21st of April, 1938, the Defendants’ Supplemental Statement were delivered.

On the 19th of October, 1938, by consent the Plaintiffs delivered their amended Statement and supplemental Statement and on the 26th of October, 1938, the Defendants delivered an amended Statement and supplemental Statement.

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The Statements of October, 1938, were rather of the nature of reprints for use at the trial than fresh Statements. The position was this, that the original Statements had dealt with Claims 1, 2, 3, 4, 5, 6, and four groups of points and signals alleged to be infringing each; whereas the final reprints alleged infringement of only Claims 1 and 2 by one alleged infringing group (another group, 5 by agreement between the parties, to follow the result of the first).

Thus whereas the original Document "X" (referred to hereafter) contained as many as 16 columns for some claims, the final reprint contained a maximum of 13 columns, but eight columns relating to the two claims now in issue.

A considerable measure of agreement was also made between the parties as to 10 the proposed amendments of the Specification, some amendments being dropped, so that in substance the issue of amendment was confined to Claim 2, and certain passages in the Specification it being agreed that Claim 3 (which became appendant by amendment) should stand or fall with Claims 1 and 2.

Infringement also was only alleged at the trial as to Claims 1 and 2. 15

The Plaintiffs' Statement was headed by a note as to which see Defendants' statement, paragraph 7.

The Plaintiffs' Statement was in four columns, and the Defendants reprinted this under the name of Document X, with further columns. The additional columns specified the parts of the prior documents and users which, the 20 Defendants alleged, corresponded to the "integers" of the claims as specified by the Plaintiffs. The Defendants also, in their Statement, included a statement of 89 paragraphs dealing with certain points in more detail.

The headings of the columns in Document X (for Claims 1 and 2) were as follows:—(Plaintiffs') (1) Integers and combinations of integers alleged to be 25 comprised in each of the claims alleged to be infringed. (2) Examples of each of such integers indicated by reference to the drawings and body of the Specification. (3) Limitations or extensions of words in claim denoting integers. (4) Parts or combinations of parts in Defendants' C.T.C. installation alleged to infringe respective claims. (Defendants') (5) *Bushnell* U.S. Specification No. 1,299,295. 30 (6) "Alternating Current Signalling"—*McCready*, pp. 384-398. (7) *Do. do.* Fig. 224, p. 404. (8) *Mersey Railway* (Manual Operation) as shown in Drawing E.671.

The following is a summary of the matter in columns 1 to 3, with extracts or notes on that in column 4. **Claim 1.** Integer 1. (i) Switch. (ii) 208. **2.** (i) Power 35 Operated Switch Machine. (ii) S.M. **3.** (i) Signals governing traffic over the switch. (ii) 1, 1^s, 2, 2^d, 3, 7, 7^d. (iii) "This is a technical phrase implying the "presence of those signals necessary having regard to the particular layout of the "permanent way to govern the passage and direction of traffic to and fro over "the switch (e.g. Signals 7 and 7^d are included in column 2 because in the 40 "example illustrated the order of movement of the signals 2, or 2^d on the one "hand and 7 or 7^d on the other hand determines the direction of traffic over the "switch 208)." **4.** (i) Manually controlled means at a remote control office. (ii) CC. (iii) Implied that this means is always free to move under the hand of the operator (see 9). **5.** (i) Relay adjacent the switch. (ii) ZF^e and 45 associated circuits and ZG^w for signals 7, 7^d. (iv) Defendants' pair of relays 6 XS, 6 YS (and associated circuits) were relied on at the trial. **6.** (i) Means enabling the relay to control the operation of the switch machine. (ii) NR, RR,

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- and associated circuits. (iv) 7 NWR, 7 RWR (normal and reverse switch operating relays). 7. (i) Means enabling the relay to control the operation of the signals. (ii) Contacts of ZF^c, of the (home) "H" relay, and detector contacts on the switch machine. (iv) Specified for the various signals including the
- 5 "home" relay (e.g. 8 LAHR), contacts of 6 XS, 6 YS and switch detector contacts. [N.B.—For certain signals the 6 XS, YS were in a "storage unit" (*ubi supra*) relating to a different set of points.] 8. (i) Single line wire and return connecting control office and relay. (ii) 39 and C. (iv) Wires X and Z or Y and Z depending on movement of the switch machine. "In the alternative
- 10 "if it is held that the Defendants' system does not fall within the strict wording "of Claim 1 by reason of the fact that the Defendants have added a code "arrangement involving the use of a third wire the Plaintiffs will contend that "such a system constitutes an equivalent of the system claimed." 9. (i) Means for interlocking relay with the signals thus enabling result specified to be obtained.
- 15 (ii) CR and associated circuits, including the signals, their home relays, and the circuit breakers controlled by the signals. (iii) "'Interlocking' is a technical "term well-known in the art as denoting an arrangement whereby the operation "of one of the elements comprised in a signalling and/or switch system is "dependent upon the condition of one or more other elements therein. In the
- 20 "claims of the Patent in suit the phrases 'remote operation,' 'relay adjacent a "switch,' 'distant control office,' 'relay interlocked with such signals' and "whereby . . . adverse to such operation,' when read in conjunction with "the remainder of the claim and with the body of the specification imply that "(1) the operator is at times free to actuate the appropriate control means
- 25 "situated in the control office to convey the electrical impulse necessary to "energize the relay adjacent the switch; (2) the relay is interlocked with the "signals by means of an arrangement of circuits which is such that an operation "of the switch machine is presented if traffic conditions are adverse to such "operation.
- 30 "The phrase 'adverse traffic conditions' is a technical term in the art and in "any proper signalling and power operated switch system for the safe operation "of switches comprises at least the following conditions under which it is well "recognised that for reasons of safety the switch machine should not be "operated:—(1) a train within the fouling section; (2) one or more of the signals
- 35 "giving immediate access to the switch not at stop; (3) a train within the "approach section moving towards the switch after having received an invita- "tion to enter such section at full speed, i.e., under a clear signal."
- "The safe movement of traffic to and fro over a switch in any system involves "numerous other well-recognised safeguards. Such safeguards are Common
- 40 "Knowledge in the art and their presence in any proper signalling system is "regarded as essential for reasons of safety. All such safeguards are included by "implication in the words 'a system for the remote operation of railway points "or switches' and are not detailed in this statement."
- (iv) (alleged infringement of integer 9) Relay 7^s (*ubi supra*) and associated
- 45 circuits including signals (their home relays and repeaters).

Claim 2. Integers 1. Switch. 2. Switch machine. 3. Signals as in Claim 1. 4. (i) Control means at a remote control office. (ii) CC. (iii) "Implied that "this means is always free to move under the hand of the operator (see integer 9,

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Claim 1)." 5. Relay adjacent the switch and 6. Means enabling the relay to control switch, as in Claim 1. 7. (i) Means enabling the relay to control the operation of the signals. (ii) (as in Claim 1). (iii) :: It is implied from the "words 'the control of the relay . . . traffic conditions' when read in conjunction with the remainder of the claims and with the body of the specification, that the control exercised by the relay over the signals is to be limited in such a manner as to prevent the operation of the signals if traffic conditions are adverse to such operation." 8. (i) Means enabling the signals to be controlled automatically in accordance with traffic conditions. (ii) Signal operating circuits including switch machine (point detector) contacts, H (home) relays, track circuits and pole changers on signals (for clear and caution selection as distinct from danger). (iv) Signal operating and "home" relays. "Note.—" In the case of each of the signals the phrase 'associated circuits' should be understood to include the contacts of the necessary track and point detector relays and the contacts controlled by the signals."

As already stated the Defendants set out in columns (v) to (viii) the parts of the alleged anticipations.

The following is a summary of the paragraphs of the Defendants' statement:—The examples of integers in column (ii) are from one type of system, a multiplicity of other examples may be covered by the claims. The assumptions and implications in column (iii) are not accepted. The claims must be construed with the Specification without added matter. **Claim 1.** 1. Identification of items 1, 2, 4 and 8 accepted. 2. "Signals governing traffic over the switch." Should include only those controlled by relay ZF^e adjacent the switch, not signals 3, 7, 7^d. 3. "Relay adjacent the switch." The relay in the claim controls the switch machine and signals and is operated through a single line wire and return, therefore a three position relay. ZG^w is adjacent a wholly distinct switch. 4. Item No. 6 should include also relays CR, CR¹. 5. . . . 6. Item No. 9. ZF^e is the relay in the claim, this relay is not interlocked but is always free to be operated if not the system would not work; CR is admitted to be interlocked. 7. The Plaintiffs head note says that there is an assumption that the system will be a practical system constructed and operated to comply with Ministry of Transport regulations. The Defendants do not admit any such assumption. 8. "Signals governing traffic over the switch" is not a technical term, the only signals referred to in the claim are those controlled by ZF^e, not 7 and 7^d. 9. There is no implication that the manual means must always be free to move. 10. No member which is always free to move can be said to be interlocked. 11. The claim does not imply that the manual means is always free. Nor is ZF^e interlocked with the signals. 12. "Adverse traffic conditions" is not a technical phrase. Claim 1 refers only to those conditions dependent on signal aspect. A train in the fouling section does not prevent movement of the switch by interlocking of ZF^e with the signals (even if there were such interlocking). 13. The precise safeguards required in any system are a matter of opinion, not well recognised or common knowledge for any given system. There is no implication in the claims or body of Specification, the safeguards to be provided are expressly mentioned. **Non Infringement 14.** (All claims) (A) The Plaintiffs' system has a line wire to each switch location, and common or earth return. The Defendants' has three wires serving the whole area. Thus with 10 sets of apparatus Plaintiffs require 11, Defendants three line wires.

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- (B) Plaintiffs control both switch and signals by one relay (ZF^c), Defendants use a multiplicity and control switch and signals separately. (C) Plaintiffs have one manual lever, Defendants separate levers for switch and signals. **15.** Defendants admit the existence of the elements cited in column (iv) as infringe-
 5 ments except certain elements underlined which do not form part of the alleged circuits. **16 to 19** [Related to the identification of certain switches and signals]. **20.** Defendants deny infringement by the parts alleged, or correspondence structurally or functionally to the alleged integers of the claim. **21.** [Relating to relays 6X, 6Y became irrelevant when Plaintiffs concentrated on 6XS, 6YS].
 10 **22.** "Manually controlled means" in this claim implies a group control over switch and signals. It is also an essential feature of the invention that a three position relay (ZF^c) should be used. Defendants have neither, their signals are controlled by other relays 7XS, 7YS. **23.** [Amplifies paragraph 14A, *supra*]. The Defendants three wires can operate up to 81 switches and (independently)
 15 81 sets of signals. A complete code is necessary for any operation. Their system is not an equivalent of Plaintiffs'. If any parts correspond they were well known and available by reason of publication, and general common knowledge. **Ambiguity 24.** A. If as alleged there are to be implied by the general words of the claim additional integers it is uncertain what additional matter if
 20 any is to be implied. B. The nature of the "system" and the essential elements thereof are not sufficiently ascertained. C. It is not clear if the signals are at all times free to be moved by the relay or whether their movement is otherwise restricted. D. If "adjacent a switch" includes both relays ZF^c and ZG^w, "adjacent" is ambiguous. E. If "interlocking" refers to relay CR then
 25 since this is not the relay adjacent the switch the word "interlocked" is is ambiguous. F. . . . G. "Adverse traffic conditions," the precise meaning is not ascertainable. **Anticipation and Subject Matter. 25.** The corresponding parts are set out in Document X. **26.** *Bushnell* U.S.P. The Defendants rely on the whole Specification. If the combination in *Bushnell* differs from that
 30 claimed in Claim 1 according to the Plaintiffs' interpretation thereof, the difference does not constitute an inventive step. **27.** If the Defendants' interpretation is accepted the Defendants do not say this claim is anticipated since Plaintiffs' have reduced the number of line wires (from two and a return) to one and a return by the use of a three position relay and because there is no "direct
 35 interlocking" of the relay adjacent the switch with the signals. But there is no subject-matter in the light of common general knowledge. **28.** *ALTERNATING CURRENT SIGNALLING—McCready* and **29.** *Union Switch and Signal Company's BULLETIN 100.* (Similar contentions.)
- Claim 2.** (Unamended.) **30.** Items 1 to 6, as in Claim 1. **31.** Item 7.
 40 "Means enabling the relay to control the operation of the signals." The Defendants say the correct statement of this integer requires the addition of the words "which are controlled automatically in accordance with traffic conditions and so that the signals may be operated from the control office to
 "give indications not more favourable than actual traffic conditions."
 45 **32.** . . . **33.** The Defendants do not agree that any implication is necessary or permissible nor that Plaintiffs' paraphrase correctly represents the meaning. **Non-infringement 34. 35.** (cf. 15, 16, 20 above.) **36.** In particular in Defendants' installation there is no control means analogous to lever CC and no relay for operating both switch and signals, see paragraphs 21, 22, 23. If

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the Defendants' installation contains parts which correspond with any of the integers of the claim, such parts were well known and available by reason of common general knowledge. **Ambiguity.** 37. A. The nature of the "combination" and the essential elements are not sufficiently ascertained. B. The words "to give indications not more favourable than actual traffic conditions" convey no definite indication as to when movement of the signals is permitted or prevented. C. If "adjacent the switch" includes both ZF^e and ZG^w the word "adjacent" is ambiguous. **Anticipation and Subject-Matter.** 38, 39, 40. Similar to Claim 1. 41. Mersey Railway, not proceeded with at the trial. 42 to 88. Claims 3 to 6. 89. GENERAL. The use and operation of all the integers contained in the claims and their combinations as shown in the specification were common general knowledge and available to any person skilled in the art for the purpose of designing any particular system or layout. In particular: A. Combined automatic and manual control. B. Locking and interlocking in accordance with traffic conditions. C. Manual and electrical control from a distant control office, subject to traffic conditions. D. Approach locking and devices. E. Time releases. F. Power-operated switch machines, electrically energised relays, including three position relays, polarised relays and stick relays; contacts, circuit-controllers, reversing controllers, associated with signals and switches and in control offices; annunciators and indicators.

Plaintiffs' Supplemental Statement. This referred to the proposed amendments, particularly the new Claim 2 (see headnote). A summary is as follows:—The amendments are (A) Clerical and consequential. (B) Amendments to the body of the Specification, by way of explanation more particularly as to "traffic conditions." (C) To the claims. Claim 1. To make it clear that there is a relay (e.g., ZF^e) adjacent each switch. Claim 2. "As this claim originally stood it might have been held to cover the case in which no provision was made for preventing operation of the switch machine if traffic conditions were adverse thereto. It is clear from the body of the specification that it is in all cases contemplated that such provision should be made in order to carry into effect the purpose of the invention and the Plaintiffs desire expressly to disclaim any case in which no such provision is made. The Plaintiffs further desire to make a restatement of the claim in more precise language." [In the event the amendments to the other claims were dropped or agreed between the parties.] The statement then set out the alleged integers of the new Claim 2. The new points were as follows:—(a summary of the Defendants' comments in their supplemental statement is added in italics). Integer 2. (i) "Stretch of track which includes the switch." (ii) From signals 2 and 2^a to 7 and 7^a. (iv) Stretch of track from No. 1 platform and from No. 2 platform to Signal 4R. (*The stretch of track should be bounded by signals governing traffic over the same switch, 7 and 7^a do not.*) Integer 4. (i) "Two or more signals under combined automatic control and manual control from a remote control office, which are situated at one end of the stretch of track for governing traffic over the switch in one direction." (ii) Signals 2 and 2^a. (iv) Signals 8LA, 8LB. (*The patented system does not describe any system for more than two signals.*) Integer 5. (i) "One or more opposing signals under automatic control and under independent manual control which is or are situated at the other end of the stretch of track for governing traffic in the other direction." (ii) Signals 7 and 7^a. [*Note.*—Independent manual control is through relay ZG^w.] (iv) Signal 4R and route indicators. (*Defendants*

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- deny that 7, 7^d govern traffic over switch 208. The introduction of independent manual control is wholly outside the scope of the original claim.) Integer 6. (i) Line circuits for interlocking the signals of 4 and 5 (above). (ii) Line circuits interlocking signals 2, 2^d with 7, 7^d (so that opposing traffic may not enter the single line). (iv) Line circuits connecting the H (home) relays of signals with the GP (repeater) relays of opposing signals. (Denied that the interlocking of signals of Integers 4 and 5 is an interlocking of signals governing traffic over the switch 208.) Integer 7. (i) "Relay adjacent the switch controlling the switch machine and the signals governing traffic over the switch." (ii) ZF^c and associated circuits. (iv) 6XS and 6YS in the two storage units XZYX and XZXY. (This item and item 10, no associated circuits should be included, ZF^c does not govern signals 3, 7, 7^d, nor do these govern traffic over the switch.) Integer 8. Manual means. Integer 9. Means enabling relay to control switch. Integer 10. Means enabling the relay to control the signals governing traffic over the switch (including Integers 4 and 5).

- The Defendants further, in their Supplemental Statement stated:—II. That the parts alleged, did not infringe, nor correspond to the integers. 12. That they relied on their original statement.
- 20 The Plaintiffs in their Reply Statement stated *inter alia*:—3. The relay ZF^c controls signals 7, 7^d by circuit breakers on 2, 2^d (the interlock of opposing signals). ZG^w exercises independent manual control over 7, 7^d so that trains may be directed to and fro over switch 208. 5. ZF^c is interlocked with the signals through the agency of CR. 10. *Bushnell* is not an anticipation, as regards subject-matter. *Bushnell* only discloses a special arrangement for a single switch over which trains pass in only one direction. The Plaintiffs "will, if necessary, rely upon evidence as to the actual facts of an installation at Bogeman Pass, Montana." II. *McCready* and Bulletin 100, disclose no more than combined mechanical and electrical interlocking in signal cabins.
- 30 The action came on for hearing before Mr. Justice MORTON, on the 1st of November, 1938 [from the ninth day sitting with D. M. Robinson, Ph.D., B.Sc., M.S., A.M.I.E.E., as Assessor].

- Lionel F. Heald K.C., J. P. Graham and F. J. Carrol (instructed by Crane & Hawkins) appeared for the Plaintiffs, and The Hon. Sir R. Stafford Cripps, K.C., Kenneth R. Swan, K.C. and H. J. W. Bliss (instructed by Linklaters & Paines) appeared for the Defendants.

- Heald K.C. for the Plaintiffs.—(Counsel's opening occupied 15 days, devoted for the most part to an exposition of the complicated circuits involved. The latter are sufficiently described for the purposes of this report in the Judgment and in the description following the headnote, and this matter is omitted from this summary of the speech.) This is an action for infringement of Letters Patent and there is also a motion for the amendment of the Specification; there is no counterclaim for revocation, although the Defendants allege that the Patent is bad for want of novelty, lack of subject-matter and for ambiguity.

- 45 This is the first action of importance under the amended provisions of R.S.C. LIII (A), rule 21 (a), and Statements of the contentions of both parties have been delivered. This does involve considerable expense but has simplified the issues. The Plaintiffs are not proceeding upon four of the Claims and the

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documents cited in reference thereto have been eliminated. [The question of the appointment of an Assessor was mentioned, and at a later stage an assessor was appointed, as above noted, by agreement between the parties.]

The safety of British signalling practice has been a model for the world and there has always been much collaboration with the United States so that the state of knowledge is similar. The Plaintiffs' case is that their system is a revolutionary departure from the principles of signalling and interlocking in use for the last 60 years. 5

The Block system, which for proper working requires telegraphic communication between signalmen, ensures that two trains are not in any one block. Control by signals is supplemented in the case of single line by the staff or token system, no train being allowed into the single line without a token, of which only one can be released at a time. In any railway system there is a single line problem where there are points or switches for shunting and so forth, though the system may be double track. 10 15

Safety in existing systems is attained by interlocking of the levers in the signal boxes, supplemented by electrical operation and detection of the switches and signals. This is very expensive if fully applied, and, owing to the great distances, more primitive methods had to be used in some countries, such as the United States. The Plaintiffs' system dispenses with the ordinary interlocking in the signal box, and controls the switch and signals by a relay near the switch. The Defendants use two interlocked relays and the Plaintiffs will maintain that this arrangement is "a relay," or at least an equivalent. 20

The safety precautions are applied locally to the relay and this enables much greater distances to be dealt with. The old interlocking plant was limited to a mile or so, for instance the Defendants' installation at Stanmore which is worked from Wembley $4\frac{1}{2}$ miles away, would have required a separate signal box and interlocking plant at Stanmore. 25

The A.P.B. system used in America did dispense with interlocking frames at frequent intervals. The electrical knock down of opposing signals by a train entering a single line, ensured safety, but no control or regulation of traffic. The latter had to be done by train orders, and the train crews operated the switches. The Plaintiffs' system introduced the first practical alternative by which, from a central control tower or box, long lengths of track could be controlled. 30 35

Bushnell has been cited as an anticipation, but no one found in it the solution of what was a long standing problem, whereas the Plaintiffs' system quickly found extensive application in America.

The key to their system is that interlocking in the old sense is abolished, the levers in the signal box are free to move, and the interlocking, the safety feature, is effected between the signals and switches themselves at the switch location. The channel of communication from the box to the switch and signals is no longer a part of the safety system, but is solely a means of communicating the wish of the signalman. In this sense he has a control, he can forbid or permit a signal to clear or switch to be operated, but the actual operation is always subject to local safety conditions, which may inhibit the operation. 40 45

The Claims are claims by result, that is inhibition by traffic conditions and, although the Defendants plead ambiguity, there is no plea of insufficiency or inutility; the result can be obtained by the instructions given and it would be

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- unjust to hold the Patentee to specific means. (*British Thomson-Houston Co., Ltd. v. Corona*, (1922) 39 R.P.C. 49, and *No-Fume, Ltd. v. Pitchford*, (1935) 52 R.P.C. 231, were referred to). Turning to the figures in the Specification, figures 1 and 2. The old system would have required a signal
- 5 box to each switch, whereas the Patentee controls a number from one box or control tower. The signals 1 and 1^s do not exercise control of the direction of traffic over the switch but merely indicate siding or main line, the direction of traffic is done by signals 7 and 7^d at the next switch which admits traffic from right to left on to the single line, and signals 2 and 2^d for left to right.
- 10 The lever CC in the control tower controls the relay ZF^e at the switch, but movement of the switch is (prohibited or) permitted by the relay CC, according to traffic conditions, namely, that the signals leading over the switch are at stop, no train in the fouling section, and no train approaching under approach lock conditions.
- 15 As regards the signals, the control of ZF^e is also limited by traffic conditions, in particular signals 2, 2^d cannot be cleared unless 7, 7^s at the next siding (ZG^w, Fig. 1) are at stop. Nor can 7, 7^s be put to clear (by ZG^w) unless 2, 2^d are at stop.
- In this way ZF^e controls 7, 7^s as well as the signals 2, 2^d, 1, 1^s immediately
- 20 adjacent the siding.
- The two relays ZF^e, ZG^w together control the direction of traffic left to right and right to left over the stretch of single line O.
- In Claim 1 (but not in Claim 2) the particular means of energizing ZF^e is mentioned, namely, two line wires. The Defendants by a third wire are able to
- 25 serve 81 switches, but at a given time are using two wires or they are merely using an equivalent.
- The Plaintiffs' system is in successful operation in a number of places in America, for instance, at Fostoria, 37 miles of single track with passing sidings, and three miles of double track. The Defendants are only working over
- 30 4½ miles, but even that would have been impossible on the old system. In the Plaintiffs' system as patented there is only one lever CC for both switch and signals, but it is quite simple to add a signal lever to make an additional break in the signal circuits, so as to have an additional means of putting the signals to danger. This is what the Defendants have done.
- 35 The Plaintiffs' and the Defendants' systems are distinguished from previous practice by a localised interlocking system, interlocking the functions at the switch location, and not interlocking the levers in the signal box. All that is there needed is a means of sending a message to the local apparatus and the latter will prevent unsafe operation.
- 40 In Claim 1 the word interlocked must be construed from the Specification; it does not mean that the relay is not operated but that its effective operation in causing the movement of the switch is prevented, is dependent on the condition of the signals. The latter are interconnected with the position of the switch and also with the CR circuit and the whole claim is qualified by the word
- 45 "whereby". So far as the volition of the signaller is concerned, the movement of the switch may be initiated but is prevented if traffic conditions are adverse (**Morton J.**—As a matter of first impression Claim 1 seems applicable to ordinary interlocking; if you attempt to move the lever that is a manually-initiated

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operation, though nothing happens). The Plaintiffs do not intend, and never intended, to include the ordinary interlocking. The word interlocked cannot be read literally (the Defendants' statement was referred to). (**Morton J.**—The Defendants may say:—(a) You must read "interlocked with the signals" literally, (b) If so, the result is inutility). If the Defendants are introducing 5 a plea of inutility by an obscure passage in particulars, it is introducing a fresh issue, which should not be allowed without pleading.

As regards the amendment of Claim 2, the position is similar to that in the recent *Mullard* amendment case (*Mullard Radio Valve Co., Ltd. v. British Belmont Radio Ltd.*, (1938), 55 R.P.C. 197). The claim failed to specify all the ingredients necessary to obtain the result, for instance, reference to the safety control of the switch was omitted. The Plaintiffs' amendment is by way of limitation, and is necessary in view of the recent decision in *Electrical and Musical Industries, Ltd. v. Lissen, Ltd.*, (1939), 56 R.P.C. 23, where a strict attitude was taken upon the construction of the claims, to the effect that it is not legitimate 15 to diminish the ambit of the monopoly merely because the patentee has described his invention in more restricted terms than in the claim. (The proposed amendment of Claim 2 was then considered.) The amendment is on all fours with the *Mullard* case. There is put into the Claim what should have been there originally. As regards Claim 3, this deals with approach locking, of a particular type and the Defendants do not infringe it, owing to the particular arrangement of their signals. Various documents were cited against this Claim, but, as a result of negotiations between the parties, it has been agreed that it should be amended so as to be appendant to Claims 1 and 2, and so as to stand or fall with them. 20 Claims 4 and 5 the Plaintiffs ask to amalgamate and the Defendants do not object since we have withdrawn an amendment substituting the words "energised to "to cause operation" for "energizing", as also in Claim 6. The Court will not be troubled with these, or later claims. 25

Turning to anticipation and subject-matter, these must be considered separately, see for instance *Gadd and Mason v. Mayor, etc., of Manchester* (1902), 9 R.P.C. 30 516. There is no direct anticipation of this Patent and the only question will be that of subject-matter. Take *McCready*, a text book describing alternating current signalling with interlocking, no one would fairly read the Plaintiffs' claims as simply re-claiming these old principles. As regards subject-matter there was a long-felt want in the United States and common knowledge was substantially the same here as there. There is authority for admitting evidence from abroad in such cases. *McCready* was common knowledge, he used a relay adjacent the switch, but failed to grasp the use of such a relay to provide local interlocking and do away with interlocking in the signal box. 35

The latter system involved a multitude of electric wires from the location to the box, with corresponding risk of failure, and in practice the distance of operation was limited to about 1,000 yards. The connecting wires form a vulnerable link in the arrangement, the safety connections are brought along two sides of a triangle, from signals to signal box and back to the switch, whereas in the Plaintiffs' arrangement they are directly between signals and switch. It is 40 unreasonable to read the *Wight* Specification as including the old arrangement with its limitation of distance. Interlocking in the Claim cannot, in view of the description, include the old arrangement with its locking of the levers. In 45

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Wight, when the man has moved the lever, he has done all he can to effect the operation, in the old interlocking the lever had to be further moved after the lever had been released.

It is important to notice that at Ashington colliery, installed by the Defendants in 1921, and cited by them, some of the interlocking remained in the signal box though the switch was remotely operated by a relay. This shows that the principle was not obvious. Turning now to the citation of *Bushnell*, the objective is a very narrow one, he was dealing with an isolated switch giving a diverging route on to one of a pair of parallel lines there is no provision for two-way working. It is simply an arrangement to work the switch so that the engine driver need not get down. *Bushnell's* signals at 7, 7¹ are not meant to be at stop at all, unless there is a train immediately ahead. The signal merely goes with the switch to indicate the route. There is no provision for approach locking, and no provision for head-on collision because it is one way working. The arrangement is merely for controlling an outlying switch and *Bushnell* states that his lever may be a lever of an interlocking machine, he does not suggest doing away with interlocking. He shows a 2 position lever, for putting the switch to normal or reverse and no intermediate danger position. It is the same proposition as in *British Thomson Houston Co., Ltd. v. Metropolitan Vickers Electrical Co., Ltd.*, (1928, 45 R.P.C. 1). *Bushnell* may show an apparatus which could be used as in the Plaintiffs' Patent, but does not show how to use it. The problem of controlling the direction of traffic never occurred to *Bushnell*, nor in any reasonable sense was a manually initiated movement of the switch prevented if traffic conditions were adverse. All that can be said is that *Wight* used as a part of his invention the remote control disclosed by *Bushnell*. As regards subject-matter it is clear that, reading *Bushnell*, further experiment or research is necessary to create the Plaintiffs' system by eliminating mechanical or electrical interlocking but giving at least equal safety and operating every switch over many miles from a single box, for traffic in both directions (which must occur in places on any system unless it is like the underground inner circle). This is confirmed by the actual installation of *Bushnell* at Bozeman Pass, he did not use a system like the Plaintiffs' on the single line through the tunnel, but had a signal box at each end. (The Mersey Railway, not subsequently relied on by the Defendants, was referred to. The Statements of case were considered. Counsel emphasised Plaintiffs' contention that Claim 2, and more particularly Claim 2 as amended, included a stretch of single track to the right of switch 208 at F^c, and that the signals governing traffic over the switch were 2, 2^d and 7, 7^d of the switch at G^w.)

As regards infringement the Plaintiffs say that the Defendants have taken the invention claimed as a matter of substance [*Nobel's Explosives Co. v. Anderson*, (1894) 11 R.P.C. 115, was referred to.] For this purpose the amended specification should be considered. The fact that the infringement is different in appearance from the article patented must not be allowed to mislead (*Jupe v. Pratt*, 1 W.P.C. 146), the infringer always adds or alters the device (*Wenham Gas Co. v. Champion Gas Co.*, (1902) 9 R.P.C. 49; *Incandescent Gas Light Co., Ltd. v. De Mare*, (1906) 13 R.P.C. 301). The mere fact that the Defendants' system is also patented does not entitle them to work it.

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The Defendants operate the installation at Stanmore from Wembley Park, 4½ miles away, but under the former practice a separate signal box and interlocking plant would have been essential. (The Defendants' apparatus was described, a brief description appears in the Railway Gazette, 14th April, 1933.)

The signal 4R admitting traffic (shunting) from the left, on the up line, 5 to the platforms, corresponds to Plaintiffs 7, 1, 1^r taken together and is under "independent manual control." The switch is worked by the two relays 6XS, 6YS which are interlocked and together constitute the "relay adjacent "the switch," ZF^c. The movement of the switch moves the detector contacts KR and thus ensures that the correct signal is cleared. There is an additional break, H^s, in the signal circuit, controlled separately from the signal box, but, if this were closed up, the rest of the circuit would operate as in the Plaintiffs' case. Another feature is the GP or signal testing contact, those on opposing signals are arranged so that opposing signals cannot be cleared together, as in the Plaintiffs' case. 10 15

The signals are also controlled by the C^s contacts of 6XS, YS, which select the signals for the appropriate platforms.

The foregoing shows that 6XS, YS controls the switch and the signals.

The safety limitations on movement of the switch are applied through the S relay. This breaks a contact and prevents the supply of the message from 20 the signalman to 6XS, YS.

The S relay is controlled by approach locking using a stick circuit of a similar type to the Plaintiffs. The S relay is also controlled so that if the signals are at clear the switch cannot be moved. The S relay performs the same function as the Plaintiffs CR, namely, to interfere with the Z relay. 25

As regards the single line wire and return, mentioned in Claim 1, it is important that Claim 2 does not include this feature. So that the Plaintiffs may have to rely on the doctrine of equivalents in Claim 1, but not Claim 2. (The use by the Defendants of a code, sent over three wires, and capable of operating 8r sets of switches and signals, was explained.) 30

(Discussion ensued as to whether the issues of amendment, construction, validity and infringement could, in part, be taken separately. *Cripps* K.C. for the Defendants pointed out that infringement might be a crucial test as to allowing amendment, and the case proceeded.) The essence of the code arrangement is that only two wires are used at a time and from a practical point of view the Defendants use a single wire and return for a given operation, alternatively the Plaintiffs rely on the doctrine of equivalents. (The construction of and proposed amendment of Claim 2 were discussed.) 35

It has been suggested that the claims include the old kind of interlocking arrangements of *McCreedy* and others and the Plaintiffs have drafted a disclaimer. [*Cripps* K.C. objected to the application for further amendment at so late a stage.] The question of amendments at the trial was considered in *British Acoustic Films Ltd. v. Nettlefold Productions*, (1936) 53 R.P.C. 221, at p. 237, and *Mullard Radio Valve Co. Ltd. v. British Belmont Radio Ltd.* (1938) 55 R.P.C. 197. (This point was not considered on appeal 56 R.P.C. 1.) (After further discussion *Morton* J. directed the Plaintiffs to prepare a fresh copy of the specification, amended in red and green, the latter including the new disclaimer and certain minor or typographical corrections. A copy was directed to 40 45

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be served upon the *Comptroller*; the application for additional amendments to be received *de bene esse* pending the Defendants' arguments.)

As regards the evidence that will be called, it will be on the basis that the American engineers called are no less familiar with the art than British
15 engineers. I am in a sense making an admission that the state of common knowledge here was as high as in America, at the date of the Patent.

Cripps K.C.—There are difficulties in accepting the evidence of the inventor, who is to be called, in such a matter, and practice which is quite familiar in America may not be common knowledge here.

10 *Heald K.C.*—Evidence of the state of an art abroad has been received in numerous cases.

[It was agreed that evidence should be received *de bene esse*, without prejudice to subsequent argument as to admissibility.]

Evidence was given on behalf of the Plaintiffs by:—*Sedgwick North Wight*
15 (the inventor); *W. R. R. M. Bennett*; *P. M. Gault*; *N. de Forest Preston*; *W. H. Ballantyne*.

Objection was taken by the Defendants to certain evidence as inadmissible, for example, to a description of certain installations in America, which were alleged to be in accordance with the Patent but of which detailed drawings were not
20 available. The evidence was received *de bene esse* on the ground that, on Appeal, a higher Court might rule that it should have been admitted.

At the conclusion of the evidence for the Plaintiffs, Counsel for the Plaintiffs and Defendants agreed a statement as to Common General Knowledge, set out below. This made it unnecessary to pursue the greater part of the objections
25 taken to the evidence (received *de bene esse*). There were however certain points remaining, for instance, the evidence as to some American installations of which plans had not been produced.

"The Plaintiffs and the Defendants are respectively prepared to admit for the
"purpose of this case that the common general knowledge of American signal
30 "engineers as to the mechanical and electrical devices and appliances in use or
"available for use in the year 1925 for signal and switch operation and control
"and as to the contents of such general treatises as *Anderson* and *McCready*
"was equally the common general knowledge of British signal engineers at the
"said date. But this admission is subject (so far as the Plaintiffs are con-
35 "cerned) to the express condition and reservation that, even if (which is not
"admitted) such common general knowledge of American signal engineers at
"the said date included knowledge of the *Bushnell* specification or of the
"*Bushnell* installation at Bozeman Pass, it is not admitted by the Plaintiffs
"that the said specification or the said installation or any matter relating thereto
40 "was a matter of common general knowledge among British signal engineers
"at the said date."

Graham summed up the evidence for the Plaintiffs.—This case is complicated by the addition by the Defendants of a code to the system, but the actual
issues are relatively simple. Claim 1 is a general claim to a power-operated
45 system, comprising a number of like units and giving centralised control. There is an inventive idea of a high order, the basis being that the interlocking frame is dispensed with, arrangements in the field being substituted. The safety provisions go across the base of the triangle instead of returning to the signal box. The claim envisages movement to and fro over the switches.

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Neither in Claim 1 nor Claim 2 is there any limitation to operation of the signals as distinct from control. In an electric circuit any break in the circuit controls it, but two or more breaks may have to be closed to operate it. The Plaintiffs are not therefore limited to the use of a single lever to operate both switch and signals; provided that the lever controls them, an additional lever 5 may be required to operate.

The Defendants allege ambiguity in the measure of control claimed, but there is no point taken on non-utility or insufficiency, and the claims are limited by the result. (*British Thomson-Houston v. Corona and No Fume Ltd. v. Pitchford, ubi supra*, were referred to.) Practical people, seeking not failure but success, 10 find quite enough in the specification. The features of control required are clearly set out, in particular there can be no real government of traffic over the switch unless the signals 7, 7^a at the other end of the single track are controlled. The fact that trains carrying out shunting operations can in part be managed by the signals 1, 1^s, 2, 2^a, at the switch does not mean that the train is controlled, because verbal instructions are also necessary. The Specification makes 15 it clear that the signalman is to have the means of selecting the direction of traffic. The interlock of the opposing signals 2 and 7 at the ends of the single track, by means of line circuits, provides the means by which this control is exercised. The proposed amendment to Claim 2 limits the claim to 2-way traffic, 20 that is cases where there is this control.

The Defendants' separate signal lever does not escape infringement, it is merely an additional control. The safety precautions are dealt with by the relay 6XS, YS, corresponding to the Plaintiffs' Z.

The Defendants maintain that the signals 7, 7^a are among those governing 25 traffic over the switch, and are necessary for two-way traffic. If these are omitted, you have one-way traffic more nearly resembling *Bushnell*, but even then there is subject-matter, for *Bushnell* had no approach lock.

Independent manual control of these signals is clearly necessary to direct traffic and this has been made clear in the amended Claim 2. 30

The principle of the amended claim is that it should contain all the necessary particulars to obtain the result as demanded by the increased strictness of construction exemplified in *Mullard Radio Valve Co. v. Philco*, (1936) 53 R.P.C. 323. 35

As regards the single line wire and return, it is clear that Claim 2 is not limited to this arrangement since it is mentioned in Claim 1 but not in Claim 2. 35

On Claim 1 the Defendants use an equivalent, a channel of communication to 6XS, YS and the Plaintiffs no longer argue that the Defendants use the exact arrangement.

On equivalents the Plaintiffs rely on *Marconi v. British Radio Telegraph & Telephone Co., Ltd.*, (1912) 28 R.P.C. 181; an equivalent may be a discovery subsequent to the date of the patent. In the present case the word "relay" is clearly used functionally and, if the relays 6XS, YS are not "a relay", they are clearly an equivalent. 40

As regards the meaning of the word "interlock" it is suggested by the Defendants that if there were an interlock between the switch and signals as provided in Claim 1, the system would not work. But it is wrong to give a meaning to the word which would exclude the installation described. (*Edison Bell Phonograph Corporation Ltd. v. Smith & Young*, (1904) 11 R.P.C. 389.) The directions are quite sufficient to enable a workman to obtain the result desired. 50

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The specification must be its own dictionary and one must read it as a whole (*Needham & Kite v. Johnson & Co.*, (1884) 1 R.P.C. 49; *British Thomson-Houston Co. Ltd. v. Corona* (No. 2), (1922) 39 R.P.C. 212 at p. 225). The word "interlock" must harmonise with the specification, and means that the effective
5 operation of the switch is prevented.

The invention is of high merit and filled a long-felt want. This is evidence supporting the presence of subject-matter. It is true that the demand and incentive were in America but common knowledge there has been admitted to be the same as here. The invention made it possible to divorce the safety
10 precautions from the means of communication, any means could thus be used from the signal box to the field, and thus the use of a code, as by the Defendants, became possible.

The Defendants attack the Patent on various grounds, they say that the claims include the old interlocking plants; the Plaintiffs now seek to insert a disclaimer if it is necessary. As regards *Bushnell*, he only dealt with one-way
15 traffic and the Plaintiffs say that the Patent is limited to two-way. Further *Bushnell* omitted approach lock which the patent includes, and *Bushnell* showed no way of directing traffic, the train order system would still be required if you had a series of *Bushnell* switches. He had no opposing signals. To
20 build up the Plaintiffs' system from *Bushnell* and allege want of subject-matter is an *ex post facto* analysis. (*British Acoustic Films Ltd. v. Nettlefold*, (1936) 53 R.P.C. 221, at pp. 221 and 250 were referred to.) The question is whether the combination as a whole was obvious or not (*Wood and Amcolite Ltd. v. Gowshall Ltd.*, (1937) 54 R.P.C. 37, at p. 40). As regards amendment, the
25 proposed amendments would clearly avoid any anticipation or destruction of subject-matter by *Bushnell*. The patentee is practically entitled to amend and for instance in *British Acoustics v. Nettlefold* (*ubi supra*) could have succeeded against the Defendants after amendment though not before. The provisions of the Act in Sections 23 and 32A, allowing damages to be recovered,
30 make this clear.

In *Molins v. Industrial Machinery Co. Ltd.*, (1938) 55 R.P.C. 31, the patent was amended and held to be infringed. The Plaintiffs have not led evidence that the original claims were framed in good faith but that can be done at a later stage (*Mergenthaler Linotype Co. v. Intertype Ltd.*, (1926) 43 R.P.C. 239). The
35 amendments are allowable if the only difference in the claim is that the invention claimed is smaller than before (*Johnson's Patent* (1937) 54 R.P.C. 151). In *Thomson's Patent*, (1934) 51 R.P.C. 241, a new idea, taken from the drawings but not specifically mentioned in the description, was allowed to be inserted in the claim. Provided that there is disclosure, it is legitimate to
40 include it in amendment.

So in Claim 2 the Plaintiffs seek to insert the inhibitions on the switch, which are clearly part of the system and to introduce a description of opposing signals which were indicated by the words "signals governing traffic over
"the switch".

45 On infringement, the Defendants take all the essential features of the invention though the installations do not at first sight resemble each other (*Jupe v. Pratt*, 1 W.P.C. 144) and infringement can be stated by the result, since the claims are limited by result. The fact that the Defendants may have made

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some improvement is immaterial. The only doubt is with regard to the single wire and return of Claim 1. If, however, it is essential in that claim, it is clearly omitted from Claim 2.

As regards the words "a relay", 6XS, YS are clearly an equivalent as in the *Benno Jaffé* case (*ubi supra*). The result of the Defendants' installation is, as in the Plaintiffs', to allow movement of the switch and clearing the signals when conditions are proper. The relay 6XS, YS controls the signals by operating the switch which in turn operates the point detector KR, and the C3 ("blink") contacts of 6XS, YS also control the signals. The opposing signals are also interlocked as in the Plaintiffs' case. It is true that the Defendants use a separate signal lever giving an additional control, but all the safety arrangements depend on 6XS, YS.

The Defendants may have exercised ingenuity, but infringement cannot be avoided by adding this to robbery. (*Wenham Gas Co., Ltd. v. Champion Gas Co., Ltd.*, (1902) 9 R.P.C. 49.)

Sir *Stafford Cripps* K.C. for the Defendants.—The stricter application of the rules of cross-examination nowadays has the disadvantage that questions involving interpretation of the specification cannot be put. It is just seven weeks in this case before the Defendants can deal with this central feature of a patent action. At present I cannot see that additional evidence on facts will be required but I shall call it if necessary. (Discussion ensued as to the order of speeches and both sides agreed that in patent actions the usual rule as to the "last word" did not apply, apart from the fact that the Defendants had put in certain documents.)

The installations appear extremely complicated at first sight but the kind of ingenuity required is really an ordinary thing to an expert in the art. These diagrams are really a special written language which is familiar to the expert, and describe a complicated particular embodiment of the general claim. The Plaintiffs have placed great stress on the idea of placing all the interlocks in the field, going across the base of the triangle instead of back to the signal-box. But, as admitted in evidence, this idea appeared in *Bushnell* and the only thing that remains is the addition of approach lock, and even of that it was admitted that one type was obvious. The Defendants however will submit that the real object of the invention was the substitution of a single line wire and return for *Bushnell's* three, and the use in consequence of the single relay ZF^e. But the Plaintiffs have argued that the use of three wires is the equivalent of two, so that this basis disappears.

There are a number of technical expressions in the document such as remote operation, signals governing traffic, but evidence is allowable if the meaning differs from that in ordinary English, but in many cases the meaning must be gathered from the document, "interlock" for example is said by the Plaintiffs to have a special meaning.

The Specification in several places (p. 1, l. 23, p. 19, l. 22) lays emphasis on generality of application, but almost the whole of the description relates to a specific embodiment. It is not for instance till p. 5, l. 39, that there is any indication of the invention. A great deal of the description is devoted to the A.P.B. system (E.P. 11804/14) and to the improved A.P.B. (Application 19506/26, E.P. 256,642), a convention document out of which the patent in suit was divided. 256,642 covers the interlock of opposing signals which it is

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now sought to reintroduce by amendment. Yet Figs. 3A and 3B are confined to the ends of a passing siding and do not take in the stretch of single track to the next siding. The system described here and in 256,642 is by way of illustration and is not part of the invention.

- 5 As regards control, the manual control is clearly operative (p. 4, l. 46, 126) and able to put the signals to danger, not merely permissive as suggested by the Plaintiffs. The interlock between opposing signals is so described and should not be as a control introduced by amendment.

The controller CC is a three-position controller, necessary for a single line
10 wire and return, and a three-position neutral polar relay, such as ZF^e, capable of operating the switch and signals to normal and reverse and also putting the signals to danger.

ZF^e is a single relay and if there is any compound relay in the document it is the pair NR, RR.

- 15 The signals governing traffic over the switch are 1, 1^a, 2, 2^a, adjacent the switch, they are the only signals dealt with in detail and are repeatedly referred to. The only passage dealing with signal 7 at ZG^w is p. 15, l. 102, and it does not suggest that the signal is controlled by ZF^e.

It is important to notice that the concluding paragraph, p. 19, l. 22, makes
20 it clear that the A.P.B. system, a system for two-way traffic on a single line, is not part of the invention, which applies therefore also to one-way traffic for instance on one line of a double track. (Claims 3-14 were read.) Several kinds of approach lock are mentioned in the claims, and they must all be within the ambit of Claim 1, if "approach lock" is included in the term "adverse
25 "traffic conditions" as suggested. Claims 11 to 13 mention single track which confirms the argument that the earlier claims include double track. The wording of the later claims also confirms the fact that the four signals adjacent the switch are those referred to in Claims 1 and 2.

In Claim 1, the four signals again are those that are interlocked. "Approach
30 lock" is not a necessary ingredient of this claim as it is dealt with in the others. The manual control means must be a three-position lever in order to control the switch and signals over a single line wire and return through a relay. The word "interlocked" must have a special meaning since the relay ZF^e is free to move, but one cannot then give it another meaning to catch the
35 infringer. The phrase "adverse traffic conditions" is vague, and impossible to define in any particular set of circumstances, unless you confine it to the condition of the four signals. This claim is therefore ambiguous.

Claim 1 deals mainly with switch operation and Claim 2 with the signals. Claim 2 is confined to a single interlocking unit, whereas Claim 1 applies to
40 the whole system.

The words "control of the relay" in this claim mean its control by the signalman, involving ability to put the signals to stop. This requires a three-position relay and three-position lever which again limits this claim to a single line wire and return.

- 45 (Discussion ensued as to the admissibility of a pamphlet written by Mr. Wight, the inventor, and put to him in cross-examination. Held, that the document was irrelevant on any point of construction but could be used by way of comment on his evidence.) The evidence showed that the system

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was intended for both single and double line. The adverse traffic conditions are different in the latter case and signals governing traffic are obviously those at the switch.

The phrase "adverse traffic conditions" is shown by the evidence not to be a technical phrase. If it covers more than the signals being at stop, it must include a train on the fouling track. But beyond that there is no agreement, the evidence is that approach lock is not always necessary. If however "approach lock" is included there are several kinds and all must be included, this brings in the absolute lock mentioned in Claim 4, and the evidence is that there would be no invention in adding this to *Bushnell*. It is to be observed that the existence of the Bozeman Pass installation makes *Bushnell* more than a paper anticipation though it is not a prior user in this country.

Bushnell disclosed the principle of non-vulnerable line wires, that is wires not part of the safety precautions, and had all the integers of Claim 1, except approach lock. This is on the assumption, as urged by the Plaintiffs, that two wires are the equivalent of three and two relays of one.

On "approach lock", the Plaintiff's witnesses would not admit that the stick relay type was an obvious addition to *Bushnell*, but it actually occurs in *Anderson's* handbook, though applied there to mechanical interlocking.

If the invention is merely the idea of interlock in the field, it is not novel, if it covers "approach lock" it lacks subject-matter and is not specifically mentioned in the specification or claims.

Further the claims, as worded, include the old arrangement of interlock in the cabin.

It may be that there was invention in combining all the necessary integers with the A.P.B. system, that is what makes the specification look so impressive, but that is not what is claimed. It is, however, the function of signal engineers to combine these devices together to suit a particular lay-out, though it is much like a puzzle.

When the simplest form of lay-out contemplated by the claim is considered, it is clear that all the integers are matters of common knowledge.

As regards the Plaintiffs' reliance on a long-felt want, that did not exist in this country, owing to the absence of long stretches of single line and of the train order system. Even in America the evidence only relates to cases where the Plaintiffs' system has been combined with the A.P.B. system. As regards ambiguity, monopolies are only granted for a full disclosure and precise statement. It is on account of the absence of that consideration that the Court must consider ambiguity, even if not pleaded. If interpretation is too difficult, it may result in ambiguity which is not for the Court to resolve. The patentee may gain an advantage by uncertainty, for instance, he may know of a prior document and yet so word his claim that he may argue in an action that he escapes anticipation. (*Natural Colour Kinematograph Co., Ltd. v. Bioschemes, Ltd.*, 32 R.P.C. 256; *British Thomson-Houston Co., Ltd. v. Corona, ubi supra*, were referred to.) In the latter case there was really a plea of insufficiency, treated as ambiguity, but the House of Lords construed the patent as one for a principle and not for a particular lamp, there was no insufficiency or inutility. In the present case the Defendants say that the description of the particular example is sufficient, but when looking at the claim

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it is impossible to say how much is covered. (*Electrical and Musical Industries v. Lissen, ubi supra*, was referred to.) The claim must give the exact boundary within which others must not trespass, but here no one can say what safeguards are included in the term "traffic conditions." Other points of ambiguity are "control", "adjacent the switch." "Interlocking" is clearly not used in its ordinary meaning, yet the Plaintiffs' statement gives a definition which includes the ordinary meaning. Almost the only certain thing in Claim 1 is that the adverse traffic conditions contemplated mean the aspect of the signals.

10 Claim 2 is practically admitted to be invalid in its present form, on the ground of anticipation by *Bushnell* and *McCready*.

As regards infringement the doctrine of equivalents is now relied on as regards a single line wire and return. But to get the same result as the Defendants the Plaintiffs would require not two but many wires, even for one switch. The doctrine of equivalents must only be applied to non-essential integers, which makes it necessary to determine what is the pith and marrow of the invention. (*R.C.A. Photophone, Ltd. v. Gaumont*; (1936) 53 R.P.C. 167; *Marconi v. British Radio Telegraph, etc.*, (1911) 28 R.P.C. 181, at p. 217.)

15 In the *Benno Jaffé* case the centrifugal machine was held not to be an essential feature and therefore could have an equivalent. In the present case, Claim 1 has essential features, namely, the control lever CC, the single line circuit and the master relay ZF*, controlling both switch and signals. If an equivalent is to be found, it must produce the same result and the other integers must be the same. But the Plaintiffs seek to substitute all the physical integers and the Defendants' result is not the same. These are two completely different systems. The very conception of a code system of the Defendants' type did not exist at the date of the Patent. There are many specific differences. The manual control means, the lever, must in the Plaintiffs' system be able to put the signals to stop, the mid position of the lever, whereas the Defendants use separate levers, all essential upon their system.

20 Then the line wires which, in the Defendants' system, apart from their number, perform functions of selection as well as control. The character of the impulses is different, the Plaintiff has continuous energisation which continues until the operation is complete; the Defendant has intermittent impulses and the message must be repeated if the operation is not at once effected. Then the relay ZF* of the Plaintiffs can always be operated by the control lever but the message to 6XS, YS of the Defendants may be interrupted (by safety conditions) there is no direct connection from the control lever. Fifth, the Defendants' system requires a number of relays between the line wires and 6XS, YS. Sixth, selection is an essential part of the Defendants' system but in the Plaintiffs you merely operate a particular Z relay directly. Seventh, in the Defendants' system you operate the signals and switch independently, in the Plaintiffs' system you do not, they are in fact completely interlocked since both are operated by one lever. Eighth, the Plaintiffs' switch lever can put the signals to danger or clear, the Defendants' switch lever cannot, the signal lever must be moved. Ninth, in the Plaintiffs' system the opposing signals (e.g. 2 and 1) are operated together, in the Defendants' they are not. Tenth, the Plaintiffs' safety arrangements depend, in part, on the signals going to danger if the switch and relay ZF* (and lever CC) are "out of step", the Defendants' can never get this "out of step" position. Eleventh, the Plaintiffs

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have a special kind of interlock not a true interlock, but the Defendants have a true interlock, the relays 6XS, YS are prevented from moving if safety so requires. Twelfth, one of the relays 6XS, YS is always energised for normal, or reverse, position of the switch whereas Plaintiffs' ZF^e is de-energised in said position. Thirteenth, 6XS, YS are not polar relays. Fourteenth, they are stick 5 relays. Fifteenth, separate messages or impulses are required by Defendants for switch, signals, time release and final operation. One impulse through ZF^e does all this. Seventeenth, the approach lock is worked in a different manner. Eighteenth, the Plaintiffs' signals are fully automatic, returning to caution and clear as the train recedes. The Defendants' go to danger and 10 remain so till operated from the signal box. Nineteenth, the Plaintiffs' signal and switch levers are one, therefore interlocked, operated together. Twentieth, the interlock of opposing signals in the Plaintiffs' case may cause a "race", the signals blinking alternately. Twenty-first, the Defendants' "O.S." or return information is much fuller. Twenty-second, the time release in the 15 Defendants' case is a separate manual operation, in the Plaintiffs' automatic.

No theory of equivalents can surmount all the differences in essential operation.

As regards the expression "a relay" the Plaintiffs have called evidence as to the use of this term for special types such as interlocking relay. But where pairs of relays like the Defendants' are referred to in the specification they are 20 not called "a relay." The use of the single master relay is obviously the central feature of the invention, and it must control the signals governing traffic over the switch. The latter expression does not include signal 7 (G^w) which is not governed by ZF^e in the same way as the other signals. ZF^e is also said to be interlocked with "such" signals and it is not interlocked with 25 7. Taking "control" in the sense that ZF^e governs or controls the four signals 2, 2', 1, 1', the Defendants 6XS, YS do not control the signals, but only have an indirect effect for example through the point detectors. So also the interlock is of an entirely different type.

The essential integers of Claim 1 are not as set out in the Plaintiffs' State- 30 ment of Case but they are a switch, a single wire and return, a relay adjacent the switch having certain characteristics and a particular type of interlock of the relay. The Defendants have not these integers, and to say that they have an equivalent of the whole system because they attain the same ultimate result is not the doctrine of equivalents. 35

[*Heald* stated that that was not the intention of the Statement, the equivalence should refer to integer 8 only and if necessary the Statement should be amended. There was a letter which made the matter clear enough. **Morton J.**—"In 40 "view of that letter . . . I feel disposed to allow the Plaintiffs' argument to "go forward." Leave was given to amend.]

Claim 2, however construed, is invalid, and I must now deal with its amend- ment. Section 22 says that the Court "may" allow amendment, it is not a matter of right, and although reasonable skill and knowledge need not be considered under Sections 23 and 32A till validity is determined, yet the Court has a discretion to take such matters when considering amendment. The 45 inventor *Wight* knew of *Bushnell*, according to the evidence, and the specification should not have been left so that a powerful Corporation could exercise a monopoly for years, till challenged. In *Thomson's Patent (ubi supra)* the patentees did not know of the prior documents. In the *British Acoustic* case Mr. Justice LUXMOORE took into account the fact that the defect only became 50

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apparent when the Particulars of Objection were amended. In *British Thomson-Houston Co.'s Patent* (1919, 36 R.P.C. 251) a definition of a particular kind of tungsten powder was proposed to be added. This though narrowing the scope would have converted a barren generality into something containing subject-matter. Mere disclaimer of a particular prior document is one thing but the insertion of new integers cannot be right for the purpose of introducing subject-matter by selection. One object of the amendments proposed is to bring in signal 7 in order to catch the Defendants. The amended Claim 2 would include a number of examples which were not within the old claim, it is a rewriting such as no Court has hitherto allowed.

The Disclaimer, proposed at the trial, for insertion before the claims, is presumably intended for *McCreedy*. But it introduces a new element of ambiguity, as to the possibility of independent movement of the switch and signals, yet in the specification they must be operated together.

The Patent, it is submitted, is invalid and is not infringed.

Swan K.C. followed for the Defendants.—The Defendants will not call any evidence which is very rare in a heavy case. This is largely due to the Statements of Case, which has compelled parties to examine their position at an early stage. There have also been agreed diagrams and little has been left to proof of facts, matters of construction being chiefly in issue.

A patentee cannot make a claim so wide as to include an embodiment which lacks subject-matter, even though it also covers an invention of merit, *Mullard v. Philco*, (1935) 52 R.P.C. 261. The patent is invalid if, when the system is used for one-way traffic, there is no subject-matter in view of *Bushnell*; compare *Woodrow v. Long Humphreys*, (1934) 51 R.P.C. 25. On the Plaintiffs' own case the differences from *Bushnell*, such as the single line wire and return, are equivalents, therefore Claim 1 is anticipated. Claim 2 also covers both *Bushnell* and *McCreedy*, and does not refer to approach lock, since it deals only with the signals, it also is anticipated. My second proposition is that the patentee must give a distinct statement of his invention, in accordance with Section 2, subsection (4) of the Act. The claim must state the essential characteristics of the actual invention, *Mullard v. Philco*, (1936) 53 R.P.C. 323, at p. 351.

Further, when, as in modern practice, there are a number of claims there is little room for the doctrine of equivalents, *Submarine Signal Co. v. Hughes*, (1932) 49 R.P.C. 149, at p. 175. In the *Benno Jaffé* case (*ubi supra*) there were only two claims.

Thirdly. In the *Mullard* case at p. 346, a patentee cannot claim more than he himself has said is his invention. The Court can take cognizance of excessive width of claim. The patentee has made an invention clear in the description but has claimed more widely, bringing him within Section 25, subsection (2) (i), ambiguity.

Fourthly. If the patentee wishes to claim a principle he must do so clearly, not by a general reading of the specification, *Ridd Milking Machine Co., Ltd. v. Simplex*, (1916) 33 R.P.C. 309, at p. 317. There is no suggestion of the broad idea of distant control in the specification, though the Plaintiffs opened the case on this basis. The text merely describes a specific apparatus.

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Fifthly. If there are two possible interpretations, the Court will prefer that which would make the patent consistent with common knowledge and practical success (*Patent Exploitation Ltd. v. Siemens*, (1903) 20 R.P.C. 225, at p. 234; *Parkinson v. Simon*, (1905) 12 R.P.C. 403). This, on the evidence, excludes an ordinary interlock of the relay with the signals, as being unworkable. But one cannot have it both ways. If the claim includes ordinary interlock, thus making the Defendants infringers, it is also invalid by inclusion of *McCreedy* as well as being unworkable in the Plaintiffs' system. Alternatively, the claim is ambiguous.

Sixthly. The Defendant must be taking, as a matter of substance, the invention actually claimed, not what might have been claimed. (*Marconi v. Mullard*, (1924) 41 R.P.C. 323, at p. 334, citing *Nobel v. Anderson*.)

Seventhly. A prior document may be read with the addition of common knowledge; one form of approach lock, the absolute lock, was admitted to be known and can be added to *Bushnell*. Even the special type mentioned in Claim 3 was said by one witness to be merely a matter of design. Eighthly. As regards the construction of the specification, the description and drawings embody also the concurrent, divided-out invention, and the old A.P.B. system. There is a risk that these may be considered part of the invention, but it is made clear that the "means and operations" or "features" may be applied to other systems. The description is deliberately confined to a specific apparatus and no variations are suggested in this, but only in the application to different systems. Construction is difficult because there is not the usual description of the nature of the invention, before going to the preferred example. The specific nature of the apparatus is apparent in many passages, for instance the insistence upon the out of step principle as between the switch and relay ZF^e. This emphasises the use of a polar relay. The claims therefore should claim the apparatus and if they go beyond that they are too wide. Each claim should be looked at to see what integers form the pith and marrow of that claim (*French v. Chalco* (1938) 55 R.P.C. 157), picked out by that claim. Then since Claim 3 selects approach lock, it is not included in Claims 1 and 2, and some of the ambiguity disappears, as to the words "traffic conditions" more particularly if the words are limited to those concerned with signal aspect. On the Defendants' interpretation Claim 1 covers only a system having a single controller (CC), with three positions, and a three-position relay (ZF^e) to follow it. The Defendants certainly do not infringe this, and anything wider would cover something not in the specification and there is insufficiency; compare the *Mullard v. Philco* case (*ubi supra*) at p. 353. [*Heald* objected that insufficiency was not in the statements. *Swan*.—It is one of those imperfections of which the Court takes notice. *Morton J.*—The order merely limits the giving of evidence. I shall hear the argument.] The relay (ZF^e) must have the characteristics described in the specification, that is control both switch and signals and have the "out of step" feature if the switch and lever are in contrary positions, and there is no indication anywhere that it can be anything but a single relay.

The "signals governing traffic" are clearly those adjacent the switch controlled by ZF^e; the Plaintiffs wish to bring in signal 7 to get a different meaning for the word "control" and so include the Defendants' system, and allow the amendments sought for. "Interlock" as used in the claim means that

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the connection from ZF^o to the switch is prevented by the position of the signals, but ZF^o itself is operable. In the Defendants' case 6XS, YS cannot be altered unless the signal aspect is correct.

As regards equivalents there are three conditions, the feature must not be an
5 essential feature; the equivalent must be a recognised equivalent producing the same result, a substitute is not necessarily an equivalent; and the remaining features must be identical. The equivalence of a single line wire and return and of a single relay with the Defendants' three wires and two relays does not meet with these conditions. Claim 1 cannot possibly be infringed.

10 Claim 2 deals with the control of signals, you must obviously always be able to put them to stop and have a limited power of clearing them. In this claim automatic control is mentioned and means the automatic movement to danger, caution, clear as a train proceeds. This is an operative control and the control of the lever must be of the same nature, not merely permissive.

15 The Defendants have no relay which carries out this control, they have at least six for the purpose, and further their signals are not automatic in that sense, they merely go to danger as the train passes.

On validity, *Bushnell* is not a mere paper document but was applied in the United States; on the Plaintiffs' assumptions as to equivalents it is a
20 clear anticipation for one-way traffic and it deprives the patent of subject-matter even for two-way traffic and even if approach lock is included. *McCready* and the Defendants used one type of interlock, the only difference being that in *McCready* the interlock is brought back to the cabin. Actually the Plaintiffs use another type of interlock but, if the word is to be construed to cover both,
25 *McCready* becomes an anticipation.

As regards amendment, in *V.D. Ltd. v. Boston Deepsea, etc., Co. Ltd.*, (1935) 52 R.P.C. 303, amendment was refused on discretionary grounds. The present patent is 13 years old and was, by the evidence, founded on *Bushnell*, yet there is no reference to him. The amendment to Claim 2 is on the face of it designed
30 to catch the Defendants by bringing in independent control of signals, and the form of control by 6XS, YS, which is not an operative control. The proposed amendment, if only intended to limit the claim to two-way traffic, could have been done quite simply, but there are at least nine important differences from the old claim (specified). Even the amended claim is ambiguous because it
35 implies two switches, one at each end of the single line and it is impossible to determine to which the relay must be adjacent. Even by these ingenious amendments the claim is not infringed, because the signal 4R is not at the end, but in the middle of a stretch of single track and because, in shunting operations, it does not in fact enable a direction of traffic to be set up, once a
40 train is beyond 4R it must come back to the platforms before any other train can come out.

As regards the proposed disclaimer to Claim 1, an amendment must cure the defect, but mere exclusion of mechanical interlock does not deal with *Bushnell*. There is also ambiguity as you may have a mixed system, partly
45 mechanical.

It is submitted that neither Claim 1 nor 2 is infringed, that both are anticipated or devoid of subject-matter, and both are ambiguous.

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Heald K.C. in reply.—The Defendants called no evidence though there were issues upon which they could have thrown light, for example, the real value of *Bushnell* as a disclosure and the manner, independent or not, in which they developed their own arrangement. (*Morton J.*—I cannot embark on surmise as to why evidence was not called.) Validity in this case is of great importance 5 apart from infringement, and to both sides for there are situations in this country, for example, Paddington Station, where the Plaintiffs' system is more suitable than a code system. (*Morton J.*—I must first construe the specification and decide whether Claims 1 and 2 are good or bad. I must then decide whether or not the amendment of Claim 2 ought to be allowed. If 10 the claims are bad, it is unnecessary to decide on infringement.) If the Defendants succeed on non-infringement on their construction, it might still be possible to express a view upon the Plaintiffs' construction. Such a decision might well prevent fresh litigation say as to the use of a multi-wire system. Whatever the nature of the claims, an invention is undoubtedly 15 disclosed in the specification. And the evidence as to the installation at Fostoria shows that there was a long-felt want. *Bushnell* had not shown the way to the elimination of interlocking plants at frequent intervals. He gave no help as to two-way traffic or the provision of proper signalling and safety precautions. Two-way traffic is of the essence of the invention. I have to admit that the invention was the application of *Bushnell's* principle of control to two-way traffic instead of to an isolated switch, and the invention is not 20 limited to the specific arrangement of the A.P.B. system. It embodies the general application of remote operation over a system, then means for direction of traffic to and fro with equal safety to that provided by the interlocking plant, abolishing the distance limitation of the latter, making a system of *Bushnell's* arrangement for isolated places. This involves the addition of approach lock, and two-way traffic over switches even on double track, unless you have something like the Underground Inner Circle. And there must be 25 power to direct the traffic, or you have nothing better than A.P.B., where the movement of the trains themselves sets up the direction, but train orders are necessary and the trainmen operate the switches. 30

The Specification must be read and construed as a whole, with the figures, and no one could imagine that the Plaintiffs intended to include the old type of interlocking plant. The Plaintiffs are, however, offering a disclaimer. 35

The divided out Specification, 256,642, has been referred to, on the question of the interlocking of signals 2 and 7, but it does not deal with interlock at all but merely with holding certain signals at stop. It is quite legitimate to refer to and include the divided matter provided the whole combination is different, and even if a claim is the same, it is only a case of concurrent claiming, not a 40 prior grant.

The claims of the divided specification clearly do not cover the interlocking of 2 and 7, but the Specification in suit treats the controllers as important features and also the governing of traffic in opposite directions, so that 7 is necessarily included. Admittedly those are difficulties in construction, but the 45 people who draft specifications have a very difficult task and are addressing a man skilled in the art; there is clearly a valuable invention which should not be tied down in details so as to deprive the patentee of any benefit. Lord *Shaw* in the *B.T.H. v. Corona* case indicated that a patentee is entitled to make

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such claims as are necessary to give him fair protection. The Specification should not for instance be confined to automatic signals of the A.P.B. type. It includes semi-automatic signals while the Defendants use semi-automatic signals of the stick type.

- 5 The phrase "signals governing traffic over the switch" in Claim 1 does not exclude signal 7 at the next switch because ZF^e is not interlocked with it, the claim does not require interlock with all the signals. The word "whereby" should be read "the combination being such that", for the approach lock is not given by interlock of ZF^e with the signals. The claim
10 should be read as one qualified by result, for a mere arrangement of circuits could very easily be avoided.

The amendments proposed in the body of the Specification are to clear up any doubt as to traffic conditions, though the latter are already in the summary; then any difficulties about Claim 1 disappear. The necessity for approach lock
15 as a condition is quite clear and the Plaintiffs would not allege infringement if it were not present. There is a discretion as to amendment, and the Plaintiffs would like to put in an actual statement, if necessary. [Morton J.—I do not think I could allow that at so late a stage. The point is dealt with in the Defendants' statement.]

- 20 As regards the word "whereby" in Claim 1, it should be read "the combination being such that", taking in all the preceding integers. The use of the words "interlocked with the signals" must not be confined to something of the nature of the original positive interlocking of levers, that meaning has gone long since for in the power frame one could move a lever
25 in one direction without hindrance, but the effective operation of the switch is dependent upon the signals.

Claim 2, the omission of reference to inhibitions on movement of the switch is admittedly a defect but the claim is not anticipated because it is for two-way traffic.

- 30 The amendment makes both these points clear, then one must consider where the next independently manually-controlled signal is, to govern traffic, that is signal 7. *Bushnell* has no such signals, only one signal to indicate whether a train is going to the siding or main line.

- As regards the proposed disclaimer, it is intended to exclude the old interlocking arrangements such as *McCready*. It says that no system is claimed
35 in which mechanical interlocking is necessitated, this is to prevent escape of infringement by inserting an interlock as a blind between two levers, the system otherwise being the same. As regards Claim 4 (absolute approach lock) it should be amended and not used against Claim 1. [Swan K.C.—Section 21, sub-
40 section 7, allows reference for purposes of construction.] (*Bushnell* was then referred to.) As regards ambiguity, *Natural Colour Kinematograph Co., Ltd. v. Bioschemes, Ltd.*, is not the leading case on the question of insufficiency causing ambiguity. *British Thomson-Houston v. Corona and No-Fume Ltd. v. Pitchford* (1935, 52 R.P.C. 231) should be referred to. Section 25, subsection 2,
45 refers to insufficiency in the body of the specification, the example, but it relates to the claims, the scope of the monopoly, and insufficiency should have been pleaded, for instance, that though "traffic conditions" are mentioned in the claim the directions are not sufficient to carry out the result. No

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evidence was called by the Defendants to this effect, or as to any difficulty or embarrassment. In the *British Thomson-Houston* case a man could not know if he infringed without testing the lamp, here what is the difficulty?

A man must know if he is dealing with adverse traffic conditions or no, and both the specification and knowledge in the art suggest approach lock. 5
[*Swan K.C.*—On the Defendants' interpretation there is no insufficiency, and no ground for the plea. The Plaintiffs' construction gives rise to ambiguity, doubt and difficulty.] With regard to Claim 2 there is also no insufficiency, or plea of it, the necessary precautions in the case of the signals are well known.

As to amendment, it was suggested that it is not possible to amend if the patent is bad for want of subject-matter or ambiguity. *Ralston v. Smith* is quoted in *British Thomson-Houston Co., Ltd.'s Patent* (1919, 36 R.P.C. 251 at p. 264), but only means that you cannot by amendment alter the language to import invention if the original specification contained nothing which had subject-matter at all. You must not insert subject-matter, but carve out that 15 which is bad, as we are trying to do here.

In *Woodrow v. Long Humphreys* (*ubi supra*) the patent was bad because it included something which had no subject-matter, but it can hardly be doubted that that could have been cured by amendment before trial. Refusal of amendment has usually been for some conduct of the patentee, or on account of surrounding circumstances; there is no authority for refusal on account of 20 ambiguity. The words of the act "explanation or correction" clearly provide for such amendments. Of course if the claim is deliberately embarrassing the Court would not exercise its discretion. The proposed amendment is clearly by way of disclaimer and partly explanation. The original claim included 25 one-way working. If limited to two-way, there must be at least the signals at the switch, but if you follow along Figure 3 you must have more signals and it is only those we bring in. The reason that we bring in only one signal at the next switch is that there may be no switch at the other end of the single track. The unit consists of the switch and an interlock stretching out 30 to the next independently controlled signal, ready for insertion anywhere in a railway system.

It cannot be said that the amendment is improper and should be refused, terms to protect the Defendants can be imposed.

The Defendants sought to differentiate *Thomson's Patent* (1934, 51 R.P.C. 35 241). Mr. Justice LUXMOORE in that case pointed out that a patent was granted for an invention not a method of describing it, and the inventive step must not be confused with the statement of alleged novelty with regard to the prior art. The differentiation may be corrected, and even fresh matter introduced. In the present instance the interlock was clearly stressed in the specification. 40

As regards the scope of the claims, the Defendants suggest that infringement can be evaded by putting an additional break in the signal circuit, but the Specification does not say that ZF^e shall be the sole control. The word "control" does not necessarily mean that ZF^e must be able to put the signals to stop. Then the use of two relays in place of one, as to the integers in a 45 claim are almost invariably functional, and a relay must be a generic term, covering for example the exhibit P.II where two relays have precisely the same effect.

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So again direct current is not a limitation and you could use alternating current, or alternating currents of different frequencies to perform the three functions by means of a combination of relays in one piece of apparatus.

The question of equivalents must be considered with respect to Claim 1, a
5 single line wire and return where the Defendants have three. There can be no equivalent of an essential feature of a claim, but it is necessary to determine what the essential feature is. In the *Benno Jaffé* case the essential feature was a means of separation, not a centrifugal machine. Here it is a means of communication, not a single line wire and return. In the *Marconi*
10 *v. British Radio* case Mr. Justice PARKER concluded that for the purposes of the invention an autotransformer was equivalent to a transformer. As a code system can be run on two wires, though the Defendants use three, there is surely equivalence.

The Defendants' relays 6XS, YS control the switch and signals though they
15 cannot put the latter to stop. [*Swan K.C.*—Nor clear them.] Control simply means putting a break in a circuit, and all such makes or breaks assist in operation. Claim 2 clearly distinguishes control and operation. Similarly the "control relay CR" does not operate the switch, it prevents operation if the signals are not at stop.

20 As regards "a relay" 6XS, 6YS are an equivalent of ZF^e, and the evidence shows that a combination of relays may be referred to as a relay, and a relay may have more than one input circuit.

In Claim 1, however, it must be a relay which can be controlled over a single line wire and return.

25 The Plaintiffs submit (1) that the specification discloses a revolutionary substitute for the interlocking frame; an arrangement by which an operator may direct traffic to and fro over a series of switches and junctions to a great distance, and provision in the field of the necessary safeguards; (2) Claims 1 and 2 cover the necessary combinations of old and new elements, the latter
30 being the interlock between opposing signals and approach lock by devices in the field.

These new combinations give new and valuable results. (*British Acoustic Films v. Nettlefold*, (1936) 53 R.P.C. 221; *Cannington v. Nuttall*, L.R. 5 H.L. 205.) (3) Claims 1 and 2 are not anticipated or deprived of subject-matter.
35 *McCready* does not describe a manually initiated operation, the levers are interlocked and not free to initiate movement, and there is nothing to limit the control of or exercised by the relay at the switch. *Bushnell* as regards Claim 1 has not a series of switches, two-way traffic, approach lock, or a single line wire and return, as regards Claim 2 (amended) limitation to two-way traffic,
40 opposing signals, approach locking. The onus on want of subject-matter is on the Defendants and has been emphasised by the American evidence (as to long-felt want). (4) The claims are not ambiguous, the Specification clearly shows what traffic conditions are. There is no plea of insufficiency or inutility nor evidence of difficulty or embarrassment. (*British Thomson-Houston v. Corona*, (1922) 39 R.P.C. 41; *No Fume v. Pitchford*, (1935) 52 R.P.C. 231.) (5) The amendment of Claim 2 is justified, by way of disclaimer and explanation, and no ground is shown for adverse exercise of discretion. (*Thomson's Patent*, (1934) 51 R.P.C. 241; *Ralston v. Smith*, 11 H.L. Cas. 223.) (6) On a true construction "control" is only that

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necessary to obtain the result and does not involve putting the signals to stop. The use of a separate lever for this by Defendants does not escape infringement. "Relay" is functional and includes any relay means capable of performing the functions. There is no limitation to a single coil, or a polar relay or direct current, or to a relay capable of three functions. (7) A single line wire and return is not an essential feature and the Defendants' interlocked relays controlled by a code over three wires are an equivalent. (8) Claim 2 is not in any event limited to a single wire and return. (9) Two interlocked relays are an equivalent of "a relay". (*Marconi v. British Radio Telegraph*, 1915, 28 R.P.C. 181.) And also evidence is that the term "relay" includes such a device. (10) Infringement is established by the evidence.

As regards the relevance of the United States evidence as to subject-matter, see *Douglas Packing Company v. Evans*, (1929) 46 R.P.C. 493, per ROMER J. at p. 508.

It is obvious that in many cases, for example the cyaniding of gold, evidence as to demand and use must come from abroad. (*British Ore Concentration Syndicate Ltd. v. Minerals Separation Ltd.*, (1908) 25 R.P.C. 741; *Cassel Gold Extracting Co. Ltd. v. Cyanide Gold Recovery Syndicate*, (1895) 12 R.P.C. 232, at p. 252, were referred to.) The Plaintiffs are entitled to succeed. [In reply to a question by his Lordship, *Swan K.C.* admitted that the installation at Fortoria, U.S.A., was substantially as disclosed, but not necessarily claimed, in the patent.]

Swan K.C. replied on the cases.—Infringement and an action for infringement must be in the country where infringement takes place. So far as subject-matter is concerned, there must be a problem in this country.

Morton J.—On the 6th of August, 1926, *General Railway Signal Company*, a corporation organised and existing under the laws of the State of New York in the United States of America, applied for Letters Patent in the United Kingdom in respect of an alleged invention which is described in the heading of the Complete Specification as "Improvements relating to signalling and "power operated switch systems for railways". The above-mentioned Company so applied as assignees of Mr. *Sedgwick North Wight*, a citizen of the United States of America. The Complete Specification was accepted on the 7th of November, 1927, and Letters Patent in respect thereof were granted and are numbered 268,822. This Patent is the Patent in suit in the present action. It is common ground that, for reasons which I need not state, the Patent in suit bears date as from the 6th of August, 1925, and will expire (unless it is extended) 16 years from that date. It is admitted on the Pleadings in this action that the Patent in suit is still subsisting and that the Plaintiff Company, *General Railway Signal Company, Limited*, a British Company, is the registered legal owner thereof.

In or about the year 1932 the Defendant Company manufactured, installed, sold and supplied for use on the Metropolitan Railway, between Wembley Park and Stanmore Stations, an installation of signal control. This installation provided a system of what is known as "centralised traffic control" and is referred to in the Pleadings as a "C.T.C. installation". A description of this installation appeared in the "Railway Gazette" of the 17th of March, 1933.

On the 17th of September, 1935, the Plaintiff Company issued the writ in this action, claiming damages for infringement of the Patent in suit and an

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injunction. On the 18th of October, 1935, the Statement of Claim was delivered, with Particulars of Breaches, complaining that the Defendants' C.T.C. installation was an infringement. The Defence was delivered on the 24th of December, 1935, with Particulars of Objections to the validity of the Patent in suit.

- 5 I now proceed to state the subsequent history of the action, partly in order to identify certain documents to which I shall have to refer hereafter and partly in order to lead up to certain observations which I desire to make on the procedure adopted in this case. The dates and events are as follows:—

29th July, 1936: First Order giving directions under Order LIIIA, rule 21A.

- 10 30th March, 1937: Defendants amend their Defence and Particulars of Objections, pursuant to an Order of the 23rd March, 1937.

- 22nd June, 1937: Second Order giving directions under Order LIIIA, rule 21A. This Order directed (inter alia) the delivery, by the Plaintiffs and the Defendants respectively, of certain statements signed by counsel. These directions were
15 given under sub-clause (b) of Rule 21A (2).

21st October, 1937: Plaintiffs' Statement delivered.

11th January, 1938: Defendants' Statement delivered.

- The Plaintiffs' Reply Statement was delivered on the 7th of April, 1938. In the meantime, the Plaintiffs, on the 21st of March, 1938, had applied
20 by Motion for liberty to amend their Complete Specification as indicated in red ink in the copy of the Specification certified by H.M. Comptroller General of Patents, Designs and Trade Marks.

- On the 25th of March, 1938, Mr. Justice SIMONDS made an Order giving the Plaintiffs liberty, on certain undertakings, to proceed with their application
52 for leave to amend and directed that the application should be made on oral evidence and should come on with the trial of the action. This Order also directed the delivery, by the Plaintiffs and the Defendants respectively, of certain Supplemental Statements signed by counsel relating to the proposed amendments and to the manner in which the Defendants' C.T.C. installation
30 was alleged to infringe the claims as proposed to be amended. The Plaintiffs' Supplemental Statement was delivered on the 7th of April, 1938, and the Defendants' Supplemental Statement was delivered on the 21st of April, 1938, and was subsequently amended.

- As sub-clause 2 (b) of Order LIIIA, rule 21A, is a new sub-clause, I think
35 that it may be helpful if I make some comments at this stage as to the result which has been produced in the present case by the directions which have been given under this sub-clause. I feel no doubt that the Statements delivered pursuant to these directions have served a very useful purpose. They have clarified and limited the issues and have thereby caused a reduction in the
40 length of the trial. Although the hearing of this case has necessarily been very protracted, I feel sure that it would have lasted many more days if these Statements had not been delivered. I think, however, that the power to order delivery of such statements is one which should be exercised with some caution. It is obvious that the preparation of such statements, which in many cases will
45 involve the employment of experts to assist counsel, must add, and sometimes add considerably, to the costs incurred prior to the hearing. In the present case I have no doubt that the total costs incurred would have been much greater if these statements had not been delivered, as the case is one of great

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complexity, and the legal advisers of the parties and the experts whom they consulted, have shown a wise discretion in endeavouring, by means of these statements and by means of certain agreements made before the trial, to concentrate the attention of the Court upon what is really essential. But I can imagine cases of a simpler character in which any saving of costs at the trial might be exceeded by the preliminary costs incurred in preparing these statements. 5

There is one other point which I should mention in dealing with the history of the case. In the course of his opening for the Plaintiffs Mr. Heald mentioned certain further amendments of the Specification which his clients desired to make, and he asked me to allow these further amendments in addition to the amendments mentioned in the Notice of Motion on the 21st of March, 1938. The further amendments are shown in green ink on the copy of the Patent in suit which is before me. I do not doubt that the Court has power, under Section 22 of the Patents and Designs Acts, 1907 to 1932, to allow further amendments put forward at the hearing, and this power was exercised by Lord Justice LUXMOORE, then Mr. Justice LUXMOORE, in the case of *British Acoustic Films, Ltd. v. Nettlefold*, 53 Reports of Patent Cases, page 221, at page 237. 10 15

Sir *Stafford Cripps* for the Defendants contended that one of the proposed further amendments was of great importance and ought to be advertised before it was considered by the Court. The amendment in question is the insertion, after the word "that" in line 38 on page 19, of the following words: "we make no claim to any system or combination in which any mechanical or electrical locking is necessitated to retrain the freedom of movement of manual control means at a central control office in order to prevent unsafe operation of any switch or signal but that". I did not consider advertisement necessary, but I intimated that the amendments shown in green ink should be brought to the notice of the *Comptroller-General*. This was done and, by a letter of the 15th of December, 1938, addressed to the Plaintiffs' solicitors, the *Comptroller* stated that he had no comment to make with regard to the proposed further amendments and did not propose to be heard in the proceedings unless so directed by the Court. 20 25 30

As to the amendments shown in red ink, no one came forward to oppose these amendments, in response to the usual advertisements, except the Defendants in this action. The *Comptroller-General* was served with notice of the application for liberty to amend and intimated that he did not wish to appear in these proceedings unless the Court desired him to do so. The Plaintiffs have undertaken to pay the costs incurred by the *Comptroller-General* to date, whatever may be the result of the action. 35 40

I ought to add that the question of amendment has been restricted in its scope by certain agreements between the parties which are contained in letters exchanged shortly before the hearing. The result of these agreements may be briefly stated as follows:—(a) The only amendments in the body of the Specification which I have to consider are the proposed insertions shown in red ink at page 2, line 88, page 4, line 77, and page 6, line 81, and the proposed insertion shown in green ink at page 19, line 38, to which I have already referred. No objection is raised to any other amendment, nor could any such objection properly be raised, in my view. (b) The only amendment in the claims which I have to consider is the proposed amendment of Claim 2. 45 50

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I shall now state, in what appears to me to be their proper order, the questions which I have to answer in this action. They are as follows:—

1. What is the true construction of the Patent in suit in its original form and, in particular, what is the true construction of Claims 1 and 2? By reason of the agreement between the parties to which I have already referred, no question arises as to any of the other claims, though the wording of these claims may throw some light upon the meaning of Claims 1 and 2.

2. Was the Patent in suit in its original form invalid upon all or any of the grounds stated in the Pleadings and Particulars? These grounds are:—

(a) That the alleged invention the subject of the Patent was not new on the 6th of August, 1925, but had been disclosed in the United Kingdom in certain publications and by certain alleged prior users specified in paragraph 1 of the Amended Particulars of Objections.

(b) That the said alleged invention was obvious and did not involve any inventive step having regard to (i) general common knowledge in the art of controlling railway signals and points on the 6th of August, 1925, and (ii) the public knowledge existing on the 6th of August, 1925, in regard to the said art and disclosed in the said publications and alleged prior users, and plans and descriptions relating thereto.

I pause here to say that the date the 6th of August, 1925, is agreed by both sides to be the relevant date, and both sides agree that in considering such matters as disclosure, general common knowledge and public knowledge, I ought to direct my attention to the state of affairs in the United Kingdom on that date.

(c) That Claims 1 and 2 in the Patent in suit are ambiguous. It is said that these Claims do not sufficiently or clearly ascertain the nature and scope of the monopoly claimed. In the Pleadings a similar objection is taken to Claims 3 and 5 and certain subsequent claims, but by reason of the agreements between the parties, to which I have already referred, I need not consider this last-mentioned objection.

I think I must arrive at a conclusion upon these two questions before I consider whether I should or should not allow the amendments.

Mr. Heald for the Plaintiffs says that I ought to consider the question of amendment as a separate issue. He points out that the application by motion for leave to amend is a separate proceeding and must be dealt with separately. No doubt this is so, but this application was directed to be made on oral evidence at the trial of the action, and I do not see how I can decide this application until I have formed my views on question 1, with the assistance of such oral evidence as is admissible.

As to question 2, both leading and junior Counsel for the Plaintiffs have pointed out that the Court can, and frequently does, give leave to amend the specification, although the patent in its unamended form was invalid. As an example of leave being given under these circumstances they have cited the case of *British Acoustic Films, Ltd. v. Nettlefold*, to which I have already referred. I accept this, but I think that the determination of question 2 should logically precede the consideration of the question whether the amendments should or should not be allowed.

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The other questions which arise, after I have decided questions 1 and 2, are as follows:—

3. Ought I to allow, in the exercise of my discretion, (a) the amendments shown in red ink, (b) the amendments shown in green ink, and, if so, to what extent and upon what terms? 5

4. Does the Defendants' installation infringe Claim 1 or Claim 2 of the Patent in suit, reading these Claims with such amendments (if any) as I allow? It was not contended at the trial that any Claim had been infringed other than Claims 1 and 2.

This action is a remarkable one in two respects. In the first place, the trial 10 has occupied the Court, during the whole or some part of the day, on no less than 38 days. This was in my view a necessary result of the complexity of the various systems of switch and signal control which had to be considered before I could arrive at a conclusion upon the issues in the action, and I desire to say that I am much indebted to each one of the four Counsel who 15 addressed me for the great assistance which they gave me. In the second place, although certain important issues of fact are raised by the Pleadings and by the Statements which have been delivered by the parties pursuant to the Orders mentioned above, the Defendants have called no evidence. Sir *Stafford Cripps*, in his speech for the Defendants, said: "The Plaintiffs' 20 "witnesses have been most generous in the admissions that they have made, "and I cannot see that there are any other facts that are required for the proof "of the Defendants' case." Mr. *Heald* suggested that, if the Defendants had put any experts into the witness box, they would have made statements which would have assisted the Plaintiffs. He also invited me to draw the inference, 25 from the fact that the Defendants called no evidence, that their case had no merits. I see no reason for drawing any such inference in the present case, and I decline to speculate as to what witnesses would have said if they had been called. My task is to decide this case on the evidence which was called and on the relevant documents. 30

Before I turn to the Specification I must attempt the task of giving some account of the prior art, since I have to approach the matter from the standpoint of a person acquainted with the prior art and with the technical terms used therein. In dealing with the prior art I am assisted by a mutual admission by the parties which was expressed at the beginning of the 17th day 35 of the trial in the following terms: "The Plaintiffs and the Defendants are "respectively prepared to admit for the purpose of this case that the common "general knowledge of American signal engineers as to the mechanical and electrical devices and appliances in use or available for use in the year 1925 40 "for signal and switch operation and control, and as to the contents of such "general treatises as *Anderson* and *McCready*, was equally the common general "knowledge of British signal engineers at the said date. But this admission "is subject (so far as the Plaintiffs are concerned) to the express condition "and reservation that, even if (which is not admitted) such common general 45 "knowledge of American signal engineers at the said date included knowledge "of the *Bushnell* specification or of the *Bushnell* installation at Bozeman Pass, "it is not admitted by the Plaintiffs that the said specification, or the said "installation, or any matter relating thereto, was a matter of common general "knowledge among British signal engineers at the said date." In view of

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this admission, while I must deal specifically with "the *Bushnell* specification" and "the *Bushnell* installation at Bozeman Pass", I need draw no distinction between the development of the art in the United Kingdom and in the United States of America up to the 6th August, 1925.

- 5 The earliest and simplest form of signal and switch control to which the evidence refers is the single, manually operated, lever placed near a switch and having direct mechanical connection to such switch, the signal being merely a target which indicated to the train crew the position of the switch. This target was mechanically linked to the switch and lever mechanism and could
10 not in any circumstances be operated independently of the switch.

- Where it was necessary to operate more than one switch the levers were often grouped together at a convenient point and connected mechanically to their respective switches, as shown on sheet 2 of the Exhibit P1. In such an arrangement each switch could be moved independently of the others. Such
15 an arrangement places the whole onus of responsibility on the man operating the levers, and is only permissible in the case of a simple arrangement of track with few trains moving over it at low speeds.

- In order to provide safeguards against mistakes by the operator, mechanical interlocking was developed many years ago. The form most generally adopted
20 was the *Saxby* and *Farmer* interlocking frame, in which the required result was achieved by a system of tappets attached to the individual levers, the tappets carrying notches which were engaged by transverse or cross-locking dogs. In mechanical interlocking systems the power required to operate the switch or signal still came from the physical effort of the signaller through
25 the mechanical connection between lever and switch or signal. The semaphore arms of signals were so constructed that they would return of themselves to the horizontal position, which was the "stop" or "danger" position, when freed of all effort applied from outside.

- Other requirements of safety were met by the use of the Block System and
30 the Staff or Token system. The block system consists in the observance of a rule that, after a train has passed a point A, a second train is not permitted to pass A on the same track until the first train is known to have passed a further point B. The stretch of track A B is called a block.

- To facilitate the working of the block system, as train speeds increased, the
35 "distant" signal was introduced and distinguished by having a fish-tail end to the semaphore blade. The distant signal, erected a suitable distance ahead of its corresponding "home" signal, was operated with it and advised the train crew of the aspect shown by the home signal some time before they reached it. If the distant signal was in the horizontal position this did not mean
40 "stop," but "proceed with caution, prepared to stop at the home signal." These were two-position signals. A similar effect was obtained by the use of three-position signals. In these signals the horizontal position meant "stop." The vertical position (vertically downwards if the signal operated in the "lower quadrant," vertically upwards if the signal operated in the "upper
45 quadrant") meant "clear," and the 45 degrees position (i.e. midway between the horizontal and the vertical) meant "proceed with caution."

In its early form the Staff or Token system depended on the rule that a train was only entitled to enter a given stretch of single track if the train crew had possession of the token for that stretch of track. There being only one such

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token in existence, no collision could occur. The system was later made more flexible by having a number of tokens for each stretch of track, locked in machines at the ends of the stretch, the machines being so inter-connected that the removal of one token locked the machines and prevented the removal of a second token until the first had been returned. This permitted two or more trains to pass in the same direction in succession. 5

In the United States the "train-order" system was widely used when trains had to travel in both directions along a single track with sidings. In this system there was an official called a central dispatcher who arranged at which sidings the trains should pass each other. 10

The invention of the track-circuit, which was used extensively many years before 1925, made automatic signalling practicable. Detector locking and, later, approach locking of the switch were also accomplished with the aid of the track-circuit.

The track-circuit is a means of indicating the presence of a train on a given section of track. The method by which this indication is given is illustrated on sheet 6 of the Exhibit P. 1 and is as follows:—Sections of the railway track are separated from one another by insulated joints. Two wires are attached, one to each rail, at one end of the track section, and a battery or other source of energy is attached to these two wires, so as to make one rail positive and the other negative with respect to that source of energy. At the other end of the track section are two wires, attached one to each rail, and connected to two terminals of a relay which operates a pivoted member, usually referred to as an armature, having one or more contacts. The principle of the track circuit system is that the current will flow from the battery along one rail and then through the coils of the relay and back to the battery along the other rail; so that under normal conditions (or in other words when there is no train on the track section) energy will be flowing through the coils of the relay and will thus be making of it an electro-magnet which will hold up the armature and close the front contacts. When a train passes on to this track section it sets up a by-pass or short circuit from one rail to the other through the wheels and axle of the train. As a result of this by-pass the relay is robbed, to a substantial extent, of its energising current, and ceases to be an electro-magnet during the time that any part of the train is on the section of the track to which the relay is connected. The de-energisation of the relay can be used to give an indication to the signalman or to make or break circuits, causing any required operations to be performed. 15 20 25 30 35

Automatic signals were arranged to show "clear" so long as the stretch of track to which they invited entry was free of trains, but to go to "stop" immediately the track relay was de-energised by a train having accepted the signal and passed into that stretch of track. 40

The automatic block signal system was an arrangement, on a track for one direction of train movement, of a number of such automatic signals, each operated by a track circuit, each signal being provided in addition with circuit controllers mechanically connected to the signal. The circuits were so arranged that the de-energisation of a track section by a train caused the signal which had just been passed by the train to go to "stop," the next signal behind it to go to "caution," and the one behind that to return to "clear." The whole system worked itself without control, except that to determine priority of right of various classes of trains it would be necessary for human control to intervene. 45 50

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To prevent a standstill caused by the possible failure of a single signal, the signals were of the "permissive" as distinct from the "absolute" or "stop and stay" type, i.e. on finding such a signal at "stop" the driver was permitted, subject to prescribed rules, to proceed, prepared to stop at any obstruction.

To adapt the automatic system for two-way working on a single track, a separate set of signals was provided for each direction of traffic and the relay interconnection was arranged so that a train travelling, for instance, from east to west, on entering the section of single track, "knocked down," i.e. put to stop, all the signals provided for west to east traffic, but operated the signals provided for east to west traffic in the manner described above.

This is called the Absolute Permissive Block or A.P.B. system, invented by Mr. Wight in 1911 and used extensively in the United States of America from 1912 onwards. It is the subject of Letters Patent No. 11,804 of 1914 in the United Kingdom. The train order system was used in conjunction with A.P.B. to give the necessary directing agency.

Having dealt briefly with the development of automatic signalling, I must now return and trace the history of a parallel development, namely, power interlocking. So long as signals and switches were operated by manual effort, the distance of the furthest switch or signal from the signal cabin remained very limited, and it thus became desirable to be able to operate these elements by electric or pneumatic power. When this was done, however, the signalman was no longer able to tell by the "feel" of the lever whether the switch or signal had actually moved as he desired, and even if this information was brought back electrically as an indication to the signalman, a dangerous condition might still arise if he failed to notice this indication. For a power operated system to be acceptable, such a contingency had to be provided for in a positive form, and this was done in the various power interlocking systems. In these systems miniature levers could be used, but a system of check-locking or indication-locking was provided which prevented the movement of the lever into its final position until an indication, generally in the form of the making of an electric circuit, had been received back from the field that the desired operation had been successfully completed. Since the mechanical lever locking was not released until movement of the lever had been completed, no dangerous condition could be caused by failure of a unit to operate. In such systems it was not necessary for the electric power to be supplied from the control point, and it became the practice for a relay near the switch machine to control the closing of a local power circuit to the switch machine. Power interlocking systems always included detector locking, that is to say, when the track circuit of the fouling section was de-energised it was impossible to throw the switch.

On tracks where train speed was high it was already common practice before 1925 to provide the additional safeguard of approach locking. If a train had already accepted a clear signal and was proceeding at high speed towards a switch it would obviously be dangerous to allow the signalman to operate the switch, since the operation might be incomplete when the train reached it. The interlock which required the home signal at the switch to be at stop before the switch could be moved was not adequate protection in this case, because the engine driver, on seeing the signal at stop, might be unable to pull up before reaching the switch. The track circuits of an approach section of adequate length, leading up to the switch, were therefore interconnected with

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the switch machine control circuits, so as to prevent operation of the switch machine when there was a train in the approach section.

Since an "absolute" approach lock of this type would be unnecessarily inflexible, various modifications were devised, among which may be mentioned the "time release" permitting the operation of the switch after a time sufficient for the train either to have passed the switch or stopped short of it; and the connection whereby the approach locking is not brought into operation if the distant signal was at "caution" when the train accepted it.

Power-interlocking systems are dealt with by *H. McCready* in a book "Alternating Current Signalling," published by the *Union Switch and Signal Co.* in 1915, and details of locking circuits are discussed by *J. Anderson* in a book entitled "Electric Locking," published by the *Simmons-Boardman Publishing Co.* in 1918. These books are referred to as "*McCready*" and "*Anderson*" in the mutual admission mentioned above. It is admitted that these were common knowledge in the United Kingdom prior to the 6th of August, 1925. In the power-interlocking arrangements therein described the mechanical lever locking in the signal box, of the *Saxby-Farmer* type, was still retained.

This was also the case in an installation made by the Defendant Company at Ashington, Northumberland, information as to which will be found in Exhibit P. 13. This exhibit includes a portion of a catalogue of the Defendants dated 1921 and a reprint of "The Railway Engineer" of June, 1922. An extra switch had to be installed on an existing system at a point too distant to permit of its being worked from the existing signal box. A low voltage switch machine was used in conjunction with a polarised relay operated over a single line wire and return from the signal box. The operating lever in the box was one lever of an interlocking frame and the safeguards between signals and switch were provided by the signal levers being included in the same interlocking frame. The detector locking, however, was done directly in the field by passing the control circuit from the signal box to the switch-machine relay through a front contact of the track relay of the fouling section. I do not think there is any evidence that approach locking was installed.

So far as the evidence before me shows, the only installation previous to 1925 in which all the safeguards which were thought necessary were carried out in the field, instead of being carried back to the signal box, was at Bozeman Pass, Montana, United States of America. This installation is admittedly an application of some of the ideas subsequently incorporated in the *Bushnell* Patent (U.S. Patent Office 1,299,295 of 1919). I have already pointed out that this patent and this installation are specifically mentioned in the mutual admission referred to above. I shall first deal briefly with the patent before passing on to consider the Bozeman Pass system.

The second and third paragraphs of the *Bushnell* Patent are as follows: "This invention relates to a railway traffic controlling system and particularly to such a system wherein switches and signals are electrically controlled from a remote point or distant station. One of the principal objects of the invention is to provide a means for electrically controlling, from a remote point or station, the operation of a railway switch, the signal governing said switch, and the signals governing the track section in which said switch is located."

The specification and drawing attached thereto describe a system in which an

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electrically driven switch machine is controlled from a distant point by a double-pole, double-throw switch over two line wires and a common return. It is to be observed that the lever shown in *McCreedy* (page 390, Fig. 219) like all the signal and switch controlling levers of power operated systems dealt with by evidence
 5 in the present case, with the exception of the *Bushnell* Patent and the Bozeman Pass installation, was restrained both by mechanical lever-locking and by indication-locking dependent for its release on the receipt of information back from the field to the effect that the required operation had been successfully completed.

The *Bushnell* Patent neither shows nor implies any restraint on the movement
 10 of the controlling "lever", i.e. the double-pole double-throw switch. The latter is always free to move under the hand of the operator. Such restraints on the movement of the switch machine as appear in this patent are all provided in the field, and are obtained by breaking the circuit of the switch machine motor. It is to be noted, however, that on page 3, line 49, the patentee says: "This
 15 "switch is shown on the drawing for the sake of simplifying the explanation as a "double-pole double-throw switch, although it might be a lever of an inter-
 "locking machine or some other form of a device suitable for performing the
 "necessary functions".

On page 8, at line 103, the patentee says: "Various changes may be made in
 20 "the particular arrangement of circuits and controlling devices shown and "described without departing from the invention or the physical embodiment
 "thereof illustrated, and also this invention may be applied to other signalling
 "systems. Also, although the particular embodiment of the invention shown is
 "designed to be operated by direct current, simple modifications apparent to
 25 "those skilled in the art of railway signalling may be made where alternating
 "current may be used as an operating medium. Although I have particularly
 "described the construction of one physical embodiment of my invention and
 "explained the operation and principle thereof, nevertheless I desire to have it
 "understood that the form selected is merely illustrative, but does not exhaust
 30 "the possible physical embodiments of the idea of means underlying my
 "invention".

I do not propose to read the claims in full, but I shall now give certain extracts from the claims which afford some indication of their nature. The first claim is as follows: "In a traffic controlling system for railways, in combina-
 35 "tion; a stretch of track divided into blocks; a switch associated with one of
 "said blocks; an electrically operated switch machine; circuits for operating said
 "switch machine to its normal and reverse positions; means controlled alter-
 "nately from a remote point or station for governing said circuits separately; and
 "other means controlled automatically by the track circuit for the block adjacent
 40 "to said switch for checking the circuits governed by said last mentioned
 "means". In claim 3, page 9, at line 37: "means for governing the operating
 "circuits for said switch machine, said means being controlled automatically by
 "the track circuit for the block adjacent to said switch and dependent upon the
 "position of both the signal governing that block and also the signalling means
 45 "governing the switch". In claim 6, page 9, line 108: "means controlled
 "automatically by the track circuit for the block adjacent to said switch and
 "dependent upon the position of the circuit controllers of the signal governing
 "said adjacent block and also of the signalling means whereby the operation of
 "the switch machine is prevented unless the said adjacent block is clear and

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" the signals governing both the main track route and the turn out route are
" set to indicate danger ".

In claim 7, page 9, line 126: " a pole changer included in said switch
" machine and governed by said motor for controlling said " (motor operating)
" circuits; a shunt circuit for short circuiting the armature of said motor after 5
" current has been cut off by the action of said pole changer ". In claim 8,
page 10, line 16: " the energizing circuit of each of said " (motor operating)
" relays including a back contact of the other of said relays ". In claim 11,
page 10, line 100: " means controlled automatically by the track relay for pre-
" venting the closing of either the normal or reverse operating circuits when said 10
" track relay is de-energised by the presence of a train on said track section ".

Physical embodiments of all these claims are shown in the drawing attached to
the *Bushnell* Patent. In particular, 37 and 38 are the relays controlled over the
line wires from the distant point, and controlling the closing of the switch machine
motor circuit for operation of the switch to the reverse and normal positions 15
respectively; and 40 is the relay by means of which the inhibitions from the
signal circuits, the manual crank lever and the track relay of the fouling section
are brought into the switch machine operating circuit.

The *Bushnell* patent undoubtedly discloses a system of remote control in which
the safeguards are carried out in the field. But Counsel for the Plaintiffs point 20
out that it does not deal with the control of traffic in two directions over a single
track, nor does it deal with approach locking.

I now proceed to the Bozeman Pass installation, which was constructed in the
year 1914, and was an application of the ideas subsequently expressed in the
Bushnell Patent to a case where there was a tunnel with a steep gradient leading 25
up to it on either side. The railway had double track except in the tunnel, and
a passing track leading off from the ascending main line on each side. Prior to
that installation it was customary at such outlying places for the train crew to
operate the switch, when necessary, to divert the train into the passing siding,
but here " to do away with the necessity for stopping trains on this mountain 30
" grade a two-arm signal and low voltage switch machine were placed at the
" lower end of each passing track, controlled by the operator in the telegraph
" office at the mouth of the tunnel ". (Evidence, Day VI, page 38.) The
switch was operated by normal and reverse relays, situated close to the switch
machine, by means of a three-point, two-way switch in the telegraph office. The 35
movement of the switch was inhibited by a train in the fouling section, or by
either of the signals not being at stop, through the agency of a relay which broke
the circuit of the switch machine motor. According to the position of the switch,
either the signal for the main track or for the passing siding was caused to show
" proceed ", but the signal could not operate to this position until the switch 40
points were fully home and locked in the required position; and further, the signal
would resume the " stop " position if the corresponding line relay (N or R)
became de-energised for any reason. No approach locking was provided in this
installation, and evidence has been given that it was not necessary, because the
gradient was so steep that trains would be moving slowly and also because the 45
passing siding was only used in special circumstances when the man at the
telegraph office received instructions from the central dispatcher. It is, however,
of interest that (as I have already said) no approach locking is mentioned in the
Bushnell Patent which was completed subsequently. I may say at this point
that Mr. *Wight* gave evidence before me and, apart from approach locking, all 50

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the safeguards considered by Mr. Wight to be necessary on a stretch of track for one direction of train movement are present at Bozeman Pass. (Evidence Day VI, page 62, line 27.)

I shall conclude my account of the prior art by setting out certain matters which are proved by evidence to have been common knowledge on the 6th of August, 1925. Instead of quoting the evidence *in extenso*, I propose to give the references to the transcript of the evidence. It is admitted by the Plaintiffs' witnesses that the following matters were common knowledge on the 6th of August, 1925: (1) Operation of a power-operated switch machine or a signal from a control cabin too distant from such switch or signal to allow of direct mechanical operation: (Day IV, page 57, lines 9 and 17). (2) The operation of such switches or signals by a local source of power, which could be turned on or off at will from the signal box, by means of a relay at the switch or signal and line wires connecting the relay to the signal box: (Day IV, page 57, lines 20 and 25). (3) The principles of approach locking: (Day IV, page 57, line 27). (4) The principle of providing interlocking means and, in particular, wholly mechanical, part mechanical part electrical, and wholly electrical systems of interlocking: (Day IV, page 58, lines 18 and 29; and page 59, lines 3 and 10). (5) The basic idea that one relay could make or break a circuit of another relay: (Day IV, page 60, line 25). (6) The A.P.B. system: (Day IV, page 61, line 1). (7) An absolute inhibition on the operation of a switch or signal accomplished by electrical interlocking, for example detector locking of a switch: (Day IV, page 63; Day II, page 35, line 31). (8) Absolute inhibition on the operation of a switch arranged to depend on the track circuit of any given section of track: (Day IV, page 65, line 5; Day II, page 36, line 1). (9) The use of circuit breakers on the signals, to give an interlock in the field between signal and switch operation: (Day IV, page 65, line 17, and page 66, line 10; Day II, page 36, line 6, to page 37, line 26). (10) The use of circuit breakers and line circuits to cause the operation of one signal to affect the position to which the next signal to it could go: (Day II, page 38, line 24). (11) The circuit controlling the signal could be passed through the points of the switch, thus ensuring that the signal could not be cleared until the switch had completed its stroke: (Day IV, page 66, line 16; Day II, page 38, line 11). (12) The selection of the signal to be cleared could be made to depend upon the position of the switch machine or switch by taking the signal circuits through the contacts of the switch machine: (Day IV, page 67, line 12). (13) Stick circuits could be provided for maintaining the energisation of a relay after its pick-up circuit had been broken: (Day IV, page 68, line 16).

These were the tools of the railway signal engineer in 1925. Faced with the problem of designing a signalling system for a given railway, such an engineer would consider the density and conditions of traffic, the safety conditions, the desirability of standardisation, the quality of the labour obtainable, and the available capital. He would then employ the known tools to fulfil all the given conditions in a most economical way. These latter observations are a paraphrase of what appears on Day IV, page 68, and Day II, page 24.

Having completed my survey of the prior art, I must now consider the Patent in suit and express my views on the construction thereof. In considering the Patent I must bear in mind that I am primarily concerned with Claims 1 and 2. These claims must, of course, be read in the light of the Specification as a whole,

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including the drawings, but what I am considering is the alleged invention which is actually claimed in Claims 1 and 2, and not the invention which the Patentee might have claimed. The Complete Specification describes a particular system for controlling traffic over a single track railway, but the Patentee makes it clear, in passages which I shall read later, that this system is not the invention for which protection is claimed, but is merely a typical arrangement given by way of illustration and embodying the various features of the invention. I have been urged, however, by Counsel for the Plaintiffs, to express my views as to whether an invention is disclosed in the body of the Specification and in the plans attached thereto. In my opinion the particular system described in the body of the Specification and in the plans was an invention. I shall now state briefly my reasons for so thinking.

This system was designed by Mr. *Wight*, and there is no doubt that Mr. *Wight* was well acquainted with *Bushnell's* Patent and with the Bozeman Pass installation. But in producing the ingenious arrangement described in the Specification and shown in the plans attached to the Specification I have no doubt that Mr. *Wight* made an invention. It must be borne in mind that a mere scintilla of invention is sufficient, and in my view more than a mere scintilla of invention is contained in the combination of devices which is shown in these plans. Whether this invention could properly be made the subject of two Patents is a point on which I need not express, and do not express, any opinion; but it was, in my view, patentable.

I have been much assisted in arriving at this conclusion by the evidence of Mr. *Gault*. Mr. *Gault* was admittedly a very distinguished American railway signal engineer, and on the Eighth Day, at page 28, he begins the description of a problem with which he was faced, and goes on to describe how he found the solution of that problem, by studying a system which had been installed at Fostoria, Ohio, United States of America. That system had been installed in July, 1927, and it has worked in a very satisfactory manner ever since that date: (see Evidence Day IV, page 13). It was a system of centralised traffic control over a stretch of track approximately 40 miles long, and it was in substance the same system as that which is described in the Specification and plans of the Patent in suit. I do not propose to read in detail the evidence of Mr. *Gault* as to the problem with which he was faced. It is sufficient to say that he was faced with a problem of traffic control over a single track 42 miles long, that he had thought about that problem for a long time and had not found any solution, that he found that solution by visiting Fostoria, that he ordered a similar system to be installed on his line, and that this system turned out to be a complete success.

Counsel for the Defendants suggested that this evidence was of no real assistance to the Court and pointed out that I am dealing with an English patent and that there was no evidence of a "long-felt want" in England which was met by the system disclosed in the Specification and plans. That is so, but I think I am entitled to receive Mr. *Gault's* evidence and to give considerable weight to it in forming my view as to whether that system was an invention. Mr. *Gault* possessed the general common knowledge which was available to signal engineers in the United Kingdom. In addition, he was acquainted with the Bozeman Pass installation, and there is no evidence that this was common knowledge in the United Kingdom. Further, he was a very distinguished signal engineer. If the

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system shown in the Specification of the Patent in suit and embodied in the Fostoria installation was not obvious to Mr. Gault, I see no reason to think it would have been obvious, in 1925, to any signal engineer in the United Kingdom.

I must not forget, however, that my first task is to construe Claims 1 and 2 in their original form; and although an invention is, in my view, disclosed in the Specification and drawings, it does not follow that this is the invention which is claimed in Claims 1 and 2.

In his closing speech Mr. Heald urged me to bear in mind the difficulties which face those who have to draft the claims in a specification. I agree that it is never an easy task, and I think it was a particularly difficult task in the present case, for two reasons. First, it is very difficult to state in words the inventive step which Mr. Wight took in designing the system to which I have referred, having regard to the store of knowledge which was available to him in 1925. Secondly, the system has been made the subject of two patents, the other of which is No. 256,642. On page 2, line 86, of the Patent in suit it is stated to be a division of Application No. 19,506, filed 6th August, 1926. That application resulted in the grant of Patent No. 256,642. The result of this division was, in my view, to increase the difficulty which faced the draftsman in framing valid claims in the Patent in suit.

I now turn to the Complete Specification of the Patent in suit, and I propose first of all to consider the Specification in its original form, with the addition only of such of the proposed amendments as are merely corrections of obvious errors. It is headed, as I have said, "Improvements relating to signalling and power operated switch systems for railways." In lines 16 to 22 on page 1 there is stated the object of the invention: "This invention relates to signalling and power operated switch systems for railways and has for its object to provide for the combined automatic and manual control from a remote point of railway switches and the signals governing the traffic over the switches." This phrase, "the signals governing the traffic over the switches," is a forerunner of the phrase in Claim 1, "the signals governing traffic over the switch." The same phrase appears in almost identical words in Claim 2. As I shall have to give this phrase very detailed consideration, I think it is convenient to make some general observations at once. To my mind this phrase when applied to a single switch would most naturally be read as referring, and referring only, to the signals on each side of the switch. They, and they alone, allow a train to pass over the switch, or forbid it to pass over the switch. Turning to the example given in Figure 3^B, one would naturally apply the phrase to signals 2 and 2^d, 1 and 1^s, the signals on each side of the switch 208. A determined effort has been made, by Counsel for the Plaintiffs, to persuade me to read this phrase as including the signals 7 and 7^a, near the western end of the siding G, which, when cleared, allow trains to proceed into the stretch of single track marked O on Figure 3^B. I may say at once that this effort has wholly failed, for reasons which will be stated as I go through the Specification. In the earlier stages of the case I was puzzled by Mr. Heald's insistence that 7 and 7^a were included among the "signals governing traffic over the switch" which are referred to in Claims 1 and 2. I think the reason may be this: If Mr. Heald could persuade me on this point, he might be able to establish that these Claims were limited to cases where the operator, in his distant cabin, could control the direction of traffic and movements of trains in two directions over a stretch of single track

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by deciding whether to clear signals 2 and 2^d at one end of the stretch, or signals 7 and 7^d at the other end of the stretch. In this way he may have hoped to combat the suggestion that these claims are anticipated, or deprived of subject-matter, by the *Bushnell* Patent. Sir *Stafford Cripps* suggested another reason, namely, that the introduction of 7 and 7^d among the signals governing traffic over the switch might enable the Plaintiffs to put a particular meaning on the word "control" in Claims 1 and 2. Whatever Mr. *Heald's* reason may be, I have no doubt, on a consideration of the Specification as a whole, that the contention of Counsel for the Plaintiffs as to the meaning of this phrase is ill-founded.

Before I pass on, I may point out that these signals 7 and 7^d do not appear in Figures 3^A or 3^B at all. The signals 7 and 7^d shown in Figure 3^A are situate near the western end of siding F, and no one has argued that these signals are included amongst the signals governing traffic over the switch 208. When I refer hereafter to signals 7 and 7^d, I mean the two signals near the western end of siding G. It is true that these signals 7 and 7^d are shown in Figure 2, but that figure is illustrating a signalling system and does not show the switch or the "manually controlled means" which appear in Claim 1.

I now proceed with the Specification: "Various specific objects of the invention, functions, advantages and characteristics will in part be apparent as the description progresses and will in part be pointed out. In order to illustrate and explain the nature of the invention a single typical arrangement or organisation for single track railroads embodying the various features of the invention will now be described, and in considering the following description and explanation it should be borne in mind that the various means and operations specifically described are of generic application and adaptable to other conditions occurring in railroad practice." From this it appears that the reader is to find specifically described "various means and operations," and I think it is clear that these are the "various features" of the invention referred to in line 31. These "means and operations" are to be specifically described, but the reader is warned that they are of "generic application" and that the "single typical arrangement" is only being described by way of illustration. It is not suggested that this typical arrangement is the invention.

I now proceed at line 39: "In describing the invention reference will be made to the accompanying drawings in which Figure 1 shows in a simplified and diagrammatic manner a portion of a single track railroad organised and equipped with apparatus embodying the invention. Figure 2 illustrates more in detail a portion of the track shown in Figure 1 between two passing sidings and some of the control circuits for the signals, Figures 3^A and 3^B taken together illustrate in detail the control circuits and apparatus for the signals and switch operating mechanism at one end of one of the sidings (F in Figure 1), and Figures 4, 5, 6 and 7 show the control circuits for various individual devices or equipment illustrated in Figures 3^A and 3^B, these circuits being segregated in this way to facilitate explanation and understanding of the wiring connections and operation."

Again it is to be noted that Figures 3^A and 3^B, which "taken together illustrate in detail the control circuits and apparatus for the signals and switch operating mechanism at one end of one of the sidings (F in Figure 1)", do not include signals 7 and 7^d. It is true that these figures are only dealing with the east end

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of siding F, but if 7 and 7^a were included among the signals governing the traffic over the switch at this end of siding F, one would have expected them to be shown.

“ While as already pointed out, the principles and specific apparatus of this
5 “ invention are adaptable to various arrangements of track on both single and
“ double track railroads, for simplicity and convenience of description and
“ explanation it is assumed that the invention is applied to a portion of a single
“ track railroad having a relatively simple and typical arrangement of passing
“ sidings such as diagrammatically shown in Figure 1 ”. I note the phrase
10 “ specific apparatus of this invention ”, which again emphasises that the inven-
tion is one consisting of specific apparatus. Moreover, this passage makes it
quite clear that the “ apparatus ” is applicable not only to two-way traffic on a
single track, but also to one-way traffic. This is of importance when one comes
to consider whether Claims 1 and 2 can be read as applying only to two-way
15 traffic.

“ In this case, referring to Figure 1, the portion of single track railroad is
“ separated in the usual way into stretches or portions of single track M, N, O
“ and P, between passing sidings or meeting points D, E, F, G and H. The
“ movement of trains over the stretches of single track and into and out of the
20 “ passing sidings, is handled by trackway signals, both automatically operated by
“ the train themselves and also manually by dispatchers or block-operators
“ located at selected intervals. In the specific case shown it is assumed that a
“ block operator will have supervision or control over three passing sidings and
“ the two intervening stretches of single track, although it is obvious that this
25 “ zone of control may be extended as far as desired. In Figure 1 are shown
“ towers 10 and 11 at which the block operators are located to handle train
“ movements over the portion of track shown, together with an additional stretch
“ of single track and a passing siding to the right of the siding H, but not
“ shown. At each end of each passing siding is a like unit of control apparatus
30 “ and circuits which is connected by one line circuit (a single line wire and a
“ common) to a control and indicating equipment in the tower of the block
“ operator having control over that corresponding siding ”.

I think lines 7* to 14 on page 2 are of considerable importance. The object of
the invention, as appears from lines 18 to 22 on page 1, is “ to provide for the
35 “ combined automatic and manual control from a remote point of railway
“ switches and the signals governing the traffic over the switches ”. Lines 7
to 14 on page 2 state briefly how this object is achieved in the example given.
At each end of each passing siding is a unit of control apparatus and circuits.
Each unit is constructed alike, and each unit is connected by one line circuit,
40 consisting of a single line wire and a common return, to a control and indicating
equipment in the tower of the block operator having control over the corre-
sponding siding.

I continue at line 14 on page 2: “ As diagrammatically shown in Figure 1, the
“ control and the indication equipment at each end of the passing sidings are
45 “ illustrated by squares designated ZD^w, ZD^e (siding D west and east ends)
“ ZE^w and ZE^e, etc., and the control and indication units at the towers are
“ similarly shown by squares designated CD^w, CD^e, CE^w and CE^e, etc. The
“ particular devices and control circuits in these equipments will be hereinafter

* Ante page 302, line 49 to page 302, line 4.

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" explained in detail ". I do not think this passage calls for any comment. " It
" is assumed that an automatic block signal system for single track railroads of
" the well-known type, commonly known as absolute-permissive-block system, or
" an A.P.B. system, will be used; and the devices and circuits necessary for a
" system embodying the features of this invention have been shown in the form 5
" adaptable for use with such an A.P.B. system ".

It is to be noted that the " features of this invention " and the devices and
circuits necessary for a system embodying these features are not adapted for use
only with an A.P.B. system. This is made quite clear by lines 22 to 34 on
page 19. " Having thus shown and described a system in which the safety 10
" afforded by the absolute-permissive-block signalling system for single track
" railways is combined with manual supervision over the signals and switches
" associated with the various sidings for the purpose of dispatching and directing
" the movement of trains, it is desired to be understood that the various features
" of the invention may be applied to other types of signal systems as hereinbefore 15
" stated for single and double track working ".

At line 35 on page 2 the Patentee goes on to deal in more detail with Figure 1:
" Accordingly, wayside signals are shown conventionally in Figure 1 and are
" arranged in accordance with an A.P.B. system, semaphore signals being
" assumed although of course any other suitable type of signal, such as the 20
" colour light, or position light signal may be used. The arrangement of signals
" is assumed to be the same at each siding and for each stretch of single track
" between the sidings, and referring to the sidings E and F and the stretch of
" single track N, there is a starting or absolute stop-and-stay signal 2 at the
" siding E governing train movement from the main track on to the stretch of 25
" single track N, and a corresponding or like starting signal 7 at the siding F.
" On the siding E is a signal 2^a, ordinarily taking the form of a dwarf signal,
" but which must be obeyed in the same way as a starting signal, which controls
" train movement from the siding on to the stretch of single track N; and a
" similar dwarf signal 7^a is provided for the other siding F. The stretch of 30
" single track N is provided with intermediate signals in accordance with common
" practice. In this case, opposite intermediate signals as distinguished from
" staggered intermediate signals are assumed to be employed and the signals 4
" and 6 govern traffic from left to right, conveniently designated east bound
" traffic, while the signals 3 and 5 govern west bound traffic. Adjacent to the 35
" siding E and governing traffic from the stretch of single track in towards the
" siding, is an automatic signal 1 and a take-siding signal S, and a similar
" signal 8 and a take-siding signal are provided for the siding F ". This passage
is not a description of the invention, but a description of the system shown in
Figure 1, to which the invention is assumed to be applied. I note reference to a 40
" take-siding signal S " at line 73.

Then follows a passage (lines 76 to 88) introductory to a description of the
A.P.B. system combined with the " manual control of certain of the signals "
described in Patent No. 256,642: " A typical A.P.B. system in its complete
" form is shown and described in detail in the specification of English Patent 45
" No. 11,804 of 1914, and the modifications of such a system to suit the various
" conditions met with in a system of the type described herein to illustrate the
" present invention are shown and described in the Specification of Application

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"No. 19,506 filed 6th August, 1926, Serial No. 256,642, of which this is a "division; detailed consideration of such systems is therefore not included "herein".

- 5 As the reader is referred at this point to two other patents, I think it is convenient to turn at once to a brief consideration of these patents. No. 256,642 is headed: "Improvements relating to railway signalling"; so that there is no reference in the heading to the operation of the switch. Nor does the invention disclosed therein purport to be an invention relating to anything
- 10 other than the control of train movement by a system of combined automatic and manual control. This is made clear by a passage on page 1, lines 15 to 66, which I shall now read: "This invention relates to a method of operation or system for regulating or controlling train movements on railroads, "and more particularly to combined automatic and manual control of signal
- 15 "indications, whereby trains may be operated almost entirely by signal indications and without train orders. Modern automatic block signal systems "assure safety of train movement, both on single track and on double track "railroads, especially if a suitable system of automatic train control is employed "to compel obedience to the signal indications in the cab or on the trackway;
- 20 "but for the efficient and expeditious movement of trains under the widely "varying conditions occurring in practice at different times on the same portion "of the railroad, it is necessary to maintain some centralised supervision "over the trains in addition to that afforded by the block signal system, "and also by rules of superiority of trains and time card rights, as is well
- 25 "known and recognised in the art. This additional supervision is commonly "provided under the present practice by train orders issued by a dispatcher "handling the trains on a selected portion of the railroad. For well known "reasons, unnecessary to discuss in detail, the use of train orders involves "various expense, as for example maintenance of local operators for the sole
- 30 "purpose of handling train orders, and occasions delay in train movement "which would be avoided, to a large degree at least, if the same instructions "or information afforded by the train orders could be communicated to the "engineers of trains by signal indications under the control of a dispatcher "or block operator having a relatively large portion of the railroad under his
- 35 "supervision. With these well recognised principles of consideration in mind, "according to the present invention, and briefly stated, it is proposed to "organise a combined manual and automatic signalling system in such a way "that a dispatcher or block operator may control train movements over an "extensive portion of the track by signal indications."
- 40 It appears, therefore, that in Patent No. 256,642 the patentee was disclosing a system by which train orders could be dispensed with and train movement could be controlled over an extensive portion of the track by means of a combined manual and automatic signalling system. He is not dealing with switch operation at all. He is adding manual control to an A.P.B. system.
- 45 I do not think that the specification No. 11,804 of 1914 requires any special comment. It contains a description of the A.P.B. system which, as I have already said, was invented by Mr. Wight. The invention disclosed in the Patent in suit purports, and necessarily purports, to be something different from the inventions described in Patents No. 11,804 of 1914 and No. 256,642,
- 50 and the reader is referred to the two last-mentioned patents for a description of the A.P.B. system and of certain modifications of such a system.

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I now return to the Patent in suit at line 89 on page 2: "In order, however, that a complete understanding of the system described to illustrate the features of the present invention may be obtained the automatic control of signals by traffic conditions in accordance with a typical A.P.B. system and the modifications in such a system by the introduction of manual control of certain of the signals as described in Application No. 19,506 filed 6th August, 1926, will be considered briefly." It appears, therefore, that the Patentee is now about to embark upon a description of the A.P.B. system with the modifications introduced by the Patent No. 256,642 (of which the Patent in suit is a division) by reference to the various figures. It is not very easy to see where this description ends and the description of the "typical arrangement embodying the various features of the invention" begins. I think, however, that the latter description begins at the last line of page 4.* At this point the Patentee turns to Figures 3A and 3B, which do not appear in Patent No. 256,642. The figures which are referred to in line 100 on page 2, namely, Figures 1 and 2, are common both to Patent No. 256,642 and to the Patent in suit. I do not propose to read in full the passage from page 2, line 100, to page 4, line 130, but there are certain parts of it which may throw some light on the construction of the claims. Mr. *Heald* relies on lines 114 to 117 on page 2 as an indication that the word "relay" in Claims 1 and 2 is not confined to a relay of the neutral-polar or polarised type. These lines are as follows: "Each of the signals is controlled by a line relay, in this case of the neutral-polar or polarised type, to provide for the usual three indications." Mr. *Heald* contends, and I think there is some force in the contention, that when the Patentee wishes to refer to a particular type of relay he describes the type specifically.

On page 3, lines 43 to 48,† there is a passage of some importance: "In addition to the signal operations just described it is expedient to discuss the control of the two signals adjacent to a passing siding and governing traffic towards it, such as the signals 1 and 3, and 6 and 8." Not, he it observed, governing traffic over the switch, but governing traffic towards the switch. It looks as if the Patentee thought that the former phrase was not an apt one to describe a group of signals which included signals so remote from the switch as 3, 6 and 8. If so, it seems to me unlikely that he would have regarded 7 and 7^d as being signals governing traffic over the switch.

On page 4, line 21‡, the Patentee begins to describe the modifications in the A.P.B. system which were introduced by Patent No. 256,642. At line 49 he again refers to the "take-siding signals S." I attach importance to the passage at lines 52 to 56: "The circuit controllers 16, 17, 21 and 20 previously described, provide a form of interlock between the signals governing traffic in the opposite direction over a stretch of single track." The circuit-controllers 16 and 17 are connected with signals 2 and 2^d, while the circuit-controllers 20 and 21 are connected with signals 7 and 7^d. Thus it follows that the Patentee is describing 2 and 2^d and 7 and 7^d as "the signals governing traffic in the opposite direction over a stretch of single track." This seems to me an apt description, and I think it is a strong indication that he would not consider 7 and 7^d to be signals which govern traffic over the switch lying between 2 and 2^d on the one side and 1 and 1^s on the other.

* Ante page 307, line 7.

† Ante page 304, line 40.

‡ Ante page 305, line 47.

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From line 77 to line 129 on page 4 there is a passage which occurs verbatim in Patent No. 256,642 (page 5, line 30 to line 52, and page 5, line 120, to page 6, line 20). I do not think I need read this passage.

At line 130 on page 4* the Patentee turns to Figures 3^A and 3^B which, as the reader has been told on page 1, line 49, "taken together illustrate in detail the control circuits and apparatus for the signals and switch operating mechanism at one end of one of the sidings (F in Figure 1)." As I have said, Figures 3^A and 3^B do not appear in No. 256,642. From this point onwards, in my view, the Patentee is describing a typical arrangement to which this invention can be applied, and the reader has been told that it embodies "the various features of the invention." First of all, down to line 29 on page 5, he gives a general description of what is shown by Figures 3^A and 3^B placed end to end. He then goes on to details, and I shall now read lines 30 to 52 on page 5: "At each end of the siding are four signals governing traffic in both directions on the main track and on to and off the siding and referring in particular to the east end of the siding signals, 1 and 1^s govern the traffic on to the main track adjacent the siding and the siding respectively, and are both stop-and-stay signals which must not be passed unless one of them is indicating proceed. In this connection it should be noted that the stop-and-stay diverging route signal 1^s and the stop-and-stay signal 1 take the place of the take-siding signal S and the permissive stop signal 1 of Figures 1 and 2 when the switch machine is remotely controlled by the operator in accordance with the present invention. The signals 2 and 2¹ govern traffic from the main track and siding respectively on to the single track section O and are again stop-and-stay signals of the same type as 1 and 1^s."

Here the Patentee refers in particular to the east end of the siding F, and he says that at this end there are four signals, whereof 1 and 1^s "govern the traffic on to the main track adjacent the siding and the siding respectively," and 2 and 2¹ "govern traffic from the main track and siding respectively on to the single track section O." The traffic there described is all traffic which passes over the switch 208 and, in my view, the Patentee is here describing the four signals which govern traffic over that switch. Further, in lines 39 and 47 he is emphasising that the stop-and-stay signals 1 and 1^s "take the place of the take-siding signal S and the permissive stop signal 1 of Figures 1 and 2" (contrast page 2, line 73†, and page 4, line 49), and he points out that this feature comes into being "when the switch machine is remotely controlled by the operator in accordance with the present invention." This, then, is one of the "various features of the invention" referred to on page 1, line 31, and it is a feature which I find referred to again on page 6, line 55‡ to line 60, which I shall read shortly

I pass over lines 53 to 99 on page 5, and at line 100 I find these words: "The apparatus CF^e located at the tower 10 corresponding to the east end of siding F includes a battery 48, the circuit controller CC having contact blades 34, 83 and 82, and an operating handle or button 50, an alarm relay 38 and a bell 79." This is, I think, the only description of the controller CC to be found in the document.

* Ante, page 307, line 7.

† Ante, page 303, line 34, and page 306, line 12.

‡ Ante, page 308 line 32.

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To continue: " Since the circuit controller CC controls a switch machine SM
" for operating the switch, and since this switch machine, if operated, will
" remain in the operated position in spite of the fact that the controller CC is
" returned to the neutral position it is desirable to indicate into which extreme
" position the circuit controller CC has last been moved so that this indicator in 5
" fact indicates the position of such switch machine provided the switch machine
" has been operated as a result of movement of the controller to such extreme
" position." This shows that the controller is to be a three-position one, since it
is to have a neutral position. The next passage describes an indicator and I
pass on to line 9 on page 6: " The controller CC is arranged to operate, over a 10
" single line wire 39 and a common return wire C which may, if desired, be
" earth, a master control relay ZF^e located adjacent the switch and adapted to
" control the switch and signals thereat." It seems perfectly clear to me that
the " signals thereat " must refer to 2 and 2^d, 1 and 1^s. Signals 7 and 7^d, which 15
may be miles away, cannot be described as signals at the switch; and it is the
signals at the switch which the master control relay ZF^e is to control. It seems
to me that this passage throws a strong light on the meaning of the word
" controlling " and on the phrase " the signals governing traffic over the
" switch " in Claim 1.

We now come to a description of the switch machine, which I need not read, 20
but at line 49 there comes another passage of some importance. " By reason of
" the fact that a switch machine is used at each entrance to each of the various
" sidings of the single track system shown in Figure 1, the apparatus governing
" the entrances to a single track section becomes a localised interlocking system,
" and for this reason the signals as stated hereinbefore governing the entrance to 25
" and the departure of trains from the sidings and main track adjacent thereto
" must be stop-and-stay signals as indicated by the square ended blades of
" signals 2, 2^d, 1 and 1^s." I cannot doubt that " the signals governing the
" entrance to and the departure of trains from the sidings and main track
" adjacent thereto " are the signals which govern traffic over the switch. And 30
the words which immediately follow make it abundantly clear that the Patentee
regards signals 2, 2^d, 1 and 1^s, as being the signals which perform this function.
Mr. *Heald* sought to bring in signals 7 and 7^d by reading the word " entrances "
in line 53 as referring to the entrance to the single track section at the west end
and the similar entrance at the east end. To my mind, the word is referring to 35
the two entrances to the stretch of single track which occur at each entrance to
each siding, namely, the entrance to the single track from the siding and the
entrance to the single track from the main line. When the Patentee speaks of
" a localised interlocking system," it is difficult to imagine that he is including
not only the four signals which stand two on each side of the entrance to the 40
siding but also the other signals which may be several miles away. But, if there
could be any doubt as to which of the two constructions is the correct one, it is
removed by the express reference to the four signals which immediately follows.

I proceed at line 61: " The stop-and-stay diverging route signal 1^s must be
" read in connection with the stop-and-stay signal 1, and these two signals must 45
" not be passed unless one of them is indicating proceed." Here again we get
the contrast which I have already pointed out when I read lines 39 to 45 on
page 5.

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At line 66: " This diverging route signal 1^a is a two-position ' zero to forty-five
 " ' degrees position signal ' and is controlled by the fouling track circuit relay 25,
 " the switch machine and the relay ZF^a in a manner more clearly pointed out
 " hereinafter. Also the stop-and-stay signals 2 and 2^d must not be passed if at
 5 " stop in accordance with well established rules of railway practice." Here we
 get the other two signals governing traffic over the switch on the other side.
 All four are stop-and-stay signals.

The Patentee then deals with the various switch machine control relays, and
 at the top of page 7 there is another reference to the four signals 2, 2^d, 1 and 1^a,
 10 and to the contacts operated by their semaphore blades. I do not think I need
 read lines 1 to 34 on page 7.

At line 35* begins the description of the operation of the system. I think I need
 only refer to the fact, pointed out on page 8, lines 32 to 52, that when the dwarf
 signal 2^d is cleared it has the result of clearing signal 1^a.

15 I think I can pass on to page 11 and read lines 37 to 72†, omitting the tracing
 of the stick circuit. " Once the relay CR has been energised, as previously
 " explained, it is maintained energised, independently of the presence of trains
 " adjacent the switch, so long as all four of the signals 2, 2^d, 1 and 1^a remain at
 " stop, due to a stick circuit which may be traced as follows ". The Patentee
 20 traces this circuit and continues: " Hence, the approach locking is not effective
 " if train movement over the switch is blocked in both directions before trains
 " come within the approach locking limits, these trains receiving signal indica-
 " tions to bring them to a stop; and so long as the signals remain at stop the
 " switch may be operated to either position even though trains have subse-
 25 " quently moved up to the switch. Whenever one of the signals is clear to
 " allow train movement over the switch, however, a train approaching the switch
 " from either direction within the limits of a control for the home relay H¹ and
 " the relay CR will prevent any subsequent operation of the switch machine ".
 Here again we have a very plain indication that the movement of trains over the
 30 switch is regarded as being governed by signals 2, 2^d, 1 and 1^a.

I now pass on to page 12, line 44†: " The approach locking features as thus
 " far described, which have been provided to guard against the throwing of a
 " switch in front of a fast moving train, would consequently lock such switch
 " against movement under conditions which commonly occur in practice unless
 35 " supplemental unlocking means is provided. The safety of the supplemental
 " unlocking means, namely, the supplemental control relay CR¹, is based on the
 " premise that it is safe to operate the switch machine if the fouling track
 " circuit containing track relay 25 is not occupied and the signals at such switch
 " have been at danger for a period of time sufficient to either stop a train or
 40 " which train, if it is not stopped, has already passed by such switch or is
 " occupying the fouling track circuit ". I entertain no doubt that " the signals at
 " such switch " are signals 2, 2^d, 1 and 1^a, and I am confirmed in this view by
 lines 64 to 85 (which I shall not read) wherein the only contacts mentioned as
 operated by signal blades are those operated by these four signals.

45 I now pass on to page 13, line 119§: " attention is particularly directed to the
 " fact that none of the signals at a switch such as 208 can assume a proceed
 " position unless the switch machine controlling it and the control relay, such as
 " ZF^a, are positioned correspondingly or are in step, so to speak; it is by virtue

* Page 309, line 34.

† *Ante*, page 313, line 43.† *Ante*, page 312, line 30.

§ Page 315, line 40.

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" of this fact that all signals will assume the stop position, a necessary requisite
 " to the picking up of the control relay CR when it is attempted to operate the
 " switch machine by energising the control relay " ZF^c. In this passage also I
 think it is clear that the only signals referred to are the same four signals.

I do not think it is necessary to read any more until I come to the " Sum- 5
 " mary " on page 18*. The Summary is an important part of the document and
 has been discussed before me at some length. I do not propose to read it in
 full, nor do I propose to recapitulate the arguments upon it which have been
 addressed to me. I shall only say that it helps to confirm my view as to the
 true meaning of the phrase " the signals governing traffic over the switch ", 10
 and that I do not gain from it any real assistance upon the other questions of
 construction arising on Claims 1 and 2. The Summary ends with the following
 sentence: " Having thus shown and described a system in which the safety
 " afforded by the absolute-permissive block signalling system for single track
 " railways is combined with manual supervision over the signals and switches 15
 " associated with the various siding, for the purpose of dispatching and directing
 " the movement of trains, it is desired to be understood that the various features
 " of the invention may be applied to other types of signal systems as hereinbefore
 " stated for single and double track working ". This passage makes it
 abundantly clear that the system which has been described in such detail is not 20
 the invention for which protection is claimed. The Patentee says: " I have
 " described a system in which certain features appear. That is not the only type
 " of signal system to which the various features of the invention may be applied.
 " They may be applied to other types of signal systems ". That is to say, they
 may be applied to other systems which may not be A.P.B. systems. The words 25
 " as hereinbefore stated " refer, in my view, to the passages on page 1, lines 34
 to 38, and lines 61 to 65, which I have already read.

The system which has been described in detail is that which is mentioned on
 page 1, lines 28 to 31†, as being " a single typical arrangement or organisation 30
 " for single track railroads embodying the various features of the invention ";
 and on page 1, lines 65 to 70‡, the Patentee has said " for simplicity and conven-
 " ience of description and explanation it is assumed that the invention is applied
 " to a portion of a single track railroad having a relatively simple and typical
 " arrangement of passing sidings ". The Patentee has not thought fit to confine 35
 his claims to the complicated arrangement which he has described in detail. No
 doubt he had reasons for not so confining it, but it seems to me that one unfortunate
 result follows: The reader has been told, on page 1, lines 18 to 22, what the
 object of the invention is. He has been given a detailed description of what is
 called (on page 1, line 28) " a single typical arrangement or organisation for 40
 " single track railroads embodying the various features of the invention "; but
 he has been warned, for instance on page 1, at lines 34 to 38, and lines 61 to 72,
 and again on page 19, lines 22 to 34, that the system or arrangement to which
 the invention is assumed to be applied is not itself the invention for which a
 monopoly is claimed. Here and there one seems to see hints as to what is the 45
 invention, as distinct from the typical arrangement given by way of illustration.
 I have already referred to one passage of this kind on page 5, lines 39 to 47.
 Again, I find in the Summary, page 18, line 116, in regard to a particular type

* *Ante*, page 321.† *Ante*, page 302, line 14.‡ *Ante*, page 302, line 33.

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of approach locking, the words: "this feature of the invention should be borne
"in mind". This seems hopeful; something is being identified as a feature of
the invention as distinct from the system described by way of illustration; but
unfortunately I find at line 102 on the same page, in regard to this very same
5 feature, the words "This feature of the system"; and looking back to find out
what "the system" is I find from lines 70 and 71 on the same page that it is
"the system shown in Figures 3^A and 3^B". Thus what appears to be a gleam
of light turn out to be a "will-o'-the-wisp" and one must turn to the Claims to
see how the Patentee defines the invention for which he claims protection.

10 Before reading the Claims I should point out that the words "for single or
"double track working" in lines 33 and 34 on page 19* are of importance.
They show that "the invention" is not confined to two-way working over a
single track. Its features may be applied to such working, but they are, as I
read this phrase, equally applicable to one-way traffic over a single line or one-
15 way traffic on each of two double lines.

I come now, at last, to Claim 1. I shall read it with the incorporation of
the proposed amendments, as I think they are clearly only amendments by
way of correction and the Defendants raise no objection to them. "A system
"for the remote operation of railway points or switches having power operated
20 "switch machines in which for each remotely operated switch manually con-
trolled means at a control office are arranged to control the operation of a
"relay adjacent the switch over a single line wire and a return wire (or an
"earth return) said relay controlling the switch machine and the signals govern-
ing traffic over the switch and being interlocked with such signals whereby
25 "a manually initiated operation of the switch machine is prevented if traffic
"conditions are adverse to such operation."

The first phrase which calls for comment is the phrase "remote operation."
I think it is clear that this phrase means: "operation from a point so far
"distant from the switch which is being operated that the switch could not
30 "be operated from such point by the physical energy of the signalman." Both
sides agree that this must be the construction of the phrase.

The next phrase which calls for comment is: "a relay adjacent the switch."
I have heard much argument, in regard to the question of infringement, as
to the type of apparatus which is included in the word "relay." It is unneces-
35 sary to discuss this at the moment. For the time being I am prepared to
assume that the word "relay" here has a clear meaning, well understood
by those skilled in the art. Both sides agree to this extent that, if one takes
as an example the switch 208 at the eastern end of the siding F shown in
Figure 3B, the relay adjacent such switch, within the meaning of Claim 1, is
40 the relay ZF^a and that the phrase "a relay adjacent the switch" would not
extend to cover the relay ZG^w.

The word "controlling" is also of importance, and the Defendants suggest,
in paragraph 24 (c) of their Statement, that it gives rise to ambiguity. Here
again, for the moment, I shall merely assume that it has a clear meaning,
45 without discussing what that meaning is. I shall express certain views as to
its meaning in a later portion of this judgment.

I now come to the phrase "the signals governing traffic over the switch."
This phrase has been the subject of a great deal of argument, but I feel no

* Ante, page 323, line 17.

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doubt that it should bear the interpretation which is sought to be placed upon it by the Defendants. They say that, taking again as an example the switch 208, the signals governing traffic over that switch are the signals 2, 2^a, 1 and 1^a, and that the signals 7 and 7^a at the western end of the siding G are not included amongst the "signals governing traffic over" switch 208 within the meaning of Claim 1. Some of the reasons for accepting the Defendants' interpretation of this phrase have been stated in the course of reading the body of the Specification, and Claim 1 itself supplies a further reason of great cogency. The relay is stated to be "interlocked with such signals," and the word "such" makes it perfectly clear that the signals with which the relay is to be interlocked are the signals governing traffic over the switch. Taking again the example shown in Figure 3B, it may be said that the relay ZF^c is interlocked with the signals 2, 2^a, 1 and 1^a, on one possible interpretation of the word "interlocked." But the relay ZF^c cannot be said to be interlocked with signals 7 and 7^a, if one gives any reasonable meaning to the word "interlocked."

If further confirmation of the Defendants' interpretation were needed, it is supplied by the phrase (in the unamended Claims 11 and 13) "a plurality of signals at the entrance to said siding governing the entrance and departure of trains to and from said siding and main track adjacent said siding," and by the phrase (in unamended Claim 12) "the signals at said siding governing traffic into and out of the single track section." I feel no doubt that each of these phrases refers (taking again Figure 3B as an example) to the signals 2, 2^a, 1 and 1^a.

I may add that the phrase "signals governing traffic over the switch" has in my view no special technical meaning. This is clear from Mr. Wight's evidence on Day VII, page 29. I mention this point because in column 3 on page 2 of the Plaintiffs' Statement the phrase is stated to be a technical one.

The next phrase with which I must deal is the phrase "and being interlocked with such signals." The word "interlocking" is dealt with by the Plaintiffs in the third column on page 4 of their Amended Statement as follows: "Interlocking" is a technical term well known in the art as denoting an arrangement whereby the operation of one of the elements comprised in a signalling and/or switch system is dependent upon the condition of one or more other elements therein." They go on to say that in the claims of the Patent in suit the phrase "interlocked with such signals," when read in conjunction with the remainder of the Claim and with the body of the Specification, imply that the relay is interlocked with the signals by means of an arrangement of circuits which is such that an operation of the switch machine is prevented if traffic conditions are adverse to such operation. I think it is established by the evidence that "interlocking" is a technical term well known in the art. I think it is also established by the evidence that the phrase "said relay being interlocked with such signals" would mean, in its ordinary technical sense, that the energisation or de-energisation of the relay in question is dependent upon the position of the signals in question. This is made clear, to my mind, by the evidence of Mr. Wight on Day V, page 63, line 9, to page 73, line 2; Day VI, page 2, line 5, to page 4, line 5; and Day VIII, page 7, line 26, to page 8, line 14. Incidentally, the first of these passages illustrates a general feature of Mr. Wight's evidence to which I shall refer later. If this is the ordinary technical meaning of the word "interlocked," and if one takes the specific example in Figure 3B of the relay ZF^c and the signals

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2, 2^d, 1 and 1^s, it would be quite untrue to say this relay is interlocked with these signals in the ordinary technical meaning of the word. The energisation of the relay ZF^e is in no way dependent upon the condition of these four signals or any of them. Mr. *Heald* suggests that in Claim 1 the words "and being
5 "interlocked with such signals" signify that the effective operation of the switch machine through the relay ZF^e is dependent upon the condition of the signals in question. This may be the correct view. For the moment, I shall only say that in my view it is plain, reading the Specification as a whole and having regard to the evidence of Mr. *Wight* referred to above, that the word
10 "interlocked" in Claim 1 cannot be limited to its ordinary technical meaning. I pass on to see whether the remainder of the claim throws any light upon the type of interlocking which is referred to.

The last phrase in Claim 1 is: "whereby a manually initiated operation of "the switch machine is prevented if traffic conditions are adverse to such opera-
15 "tion." This phrase gives rise, in my view, to grave difficulties. Mr. *Heald* contends that the effect of this phrase, introduced as it is by the word "whereby," is to make Claim 1 a claim in which the monopoly claimed is defined by reference to the result, as it was, for example, in the case of *No-Fume, Ltd. v. Frank Pitchford & Co., Ltd.*, 52 Reports of Patent Cases, pages 28 and
20 231. He says that the word "whereby" refers to all the preceding words of the claim and that what is being described is a system having various integers, whereby a particular result is obtained.

Counsel for the Defendants, on the other hand, contend that the word "whereby" relates to the interlocking of the relay with the signals. They point
25 out that there is no other integer in the Claim which could "prevent" a manually initiated operation of the switch machine, and they say that the word "whereby" is naturally linked up with the integer which immediately precedes it, namely, the interlocking of the relay with the signals. In my view this argument is well-founded. I think the Patentee is here merely stating what is to be
30 the result of the interlocking which is referred to immediately above. If this is so, the monopoly claimed is not defined by the result achieved. I may add that, if the phrase in question is not a statement of the result which is to be achieved by the interlock, there is no description at all of the nature or purpose of the interlock.

I must now consider what is the meaning of the phrase "if traffic conditions
35 "are adverse to such operation." The use of this phrase implies that there are certain conditions of traffic which are "adverse" to the operation of the switch machine. Is it possible to ascertain with any certainty what are the adverse traffic conditions referred to here? Counsel for the Defendants submit, first,
40 that this phrase means, and means only, "if any signal giving immediate "access to the switch is not at stop." The point is stated in paragraph 12 of the Defendants' Statement in the following words: "The Defendants do not agree "that the phrase 'adverse traffic conditions' as used in Claim 1 is a technical
45 "term or has any such well-recognised or definite signification as that alleged. "The Defendants will contend that the 'adverse traffic conditions' referred to "in Claim 1 are only those conditions which are concerned with the switch "operation and which are due to the signal aspects, and that although the "presence of a train in the fouling section might under some circumstances be "described as an adverse traffic condition, such a state of affairs does not come

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"within the meaning of the words as used in Claim 1 because the manually-initiated operation of the switch machine would not be prevented under such conditions by the interlocking of the relay with the signals, even if there were such interlocking."

Counsel for the Defendants submit, secondly, that if this restricted meaning is not given to the phrase "traffic conditions are adverse," it is impossible to give any definite meaning to the phrase "traffic conditions are adverse" and therefore Claim 1 is void for ambiguity.

In column 3 of page 6 of their Statement the Plaintiffs say this: "The phrase 'adverse traffic conditions' is a technical term in the art and in any proper signalling and power operated switch system for the safe operation of switches comprises at least the following conditions under which it is well recognised that for reasons of safety the switch machine should not be operated: (1) a train within the fouling section, (2) any signal giving immediate access to the switch not at stop, (3) a train within the approach section moving towards the switch after having received an invitation to enter such section at full speed, i.e., under a clear signal. The safe movement of traffic to and fro over a switch in any system involves numerous other well-recognised safeguards. Such safeguards are common knowledge in the art and their presence in any proper signalling system is regarded as essential for reasons of safety. All such safeguards are included by implication in the words 'a system for the remote operation of railway points or switches' and are not detailed in this statement." In support of their submission that Claim 1 is ambiguous, the Defendants' Counsel point to the words "at least" and say that the element of uncertainty, giving rise to ambiguity in the claim, is manifest from the Plaintiffs' own statement.

I think it is clear from the evidence that the phrase "adverse traffic conditions" is not a technical term in the art. See, for instance, the evidence of Mr. Bennett on Day II, page 42, line 18, to page 43, line 22, and of Mr. Wight on Day VII, page 30, line 18, to page 31, line 1. If the phrase had had a clear meaning in the art, I should have felt inclined to give it that meaning in Claim 1. But this is not so. Nor does the phrase "adverse traffic conditions" occur anywhere in the body of the Specification. It is also clear from the evidence that in any switch and signal installation the conditions under which it would be considered safe by signal engineers to allow the switch to be moved would vary according to the conditions. For instance, in the Bozeman Pass installation there is no approach locking, presumably because those who installed it thought this precaution unnecessary, having regard to the steep gradient leading up to the switch. Further, the evidence shows that opinions might differ among signal engineers as to what are the conditions under which movement of the switch should be prevented or delayed in any particular installation. See, for instance, the evidence of Mr. Bennett on Day II, page 10, line 23, to page 11, line 9; page 33, line 16, to page 35, line 18; page 41, line 8, to page 42, line 18; of Mr. Wight on Day VI, page 54, line 12, to page 55, line 21; Day VII, page 61, line 24, to page 63, line 29, and page 86, line 23, to page 87, line 11, and page 90, lines 16 to 35, and page 91, line 23, to page 92, line 16.

I find myself quite unable to say whether approach locking is included in this integer of the Claim or whether, if approach locking is included at all, the integer includes every kind of approach locking or only the particular type of approach

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locking which is described in the body of the Specification and in the Drawings. Moreover, I agree with the contention of Counsel for the Defendants that the uncertainty of the phrase is supported by, if not manifest from, the Plaintiffs' own statement. They mention three conditions under which the switch machine
5 should not be operated, but the words "at least" indicate that there may be many other such conditions, which are not defined in any way in the Claim.

I cannot accept the first submission of Counsel for the Defendants that the phrase "if traffic conditions are adverse to such operation" means, and means only, "if any signal giving immediate access to the switch is not at stop." If
10 that had been the meaning, I think that the Patentee would have used these or similar words to define what he meant. I think he intended the phrase to have some wider meaning, but what are the limits of that wider meaning I am quite unable to discover. Nor would it enable the Plaintiffs to succeed in this action, so far as Claim 1 is concerned, if I gave to the phrase the limited meaning
15 which is suggested by the Defendants. I say this for reasons which will appear hereafter.

In my view, the phrase which I am now considering is an ambiguous phrase. Not only is it ambiguous in itself, but being ambiguous it entirely fails to define what type of interlocking is referred to in the phrase which immediately precedes
20 it. As appears above, I am satisfied that the word "interlocked" in Claim 1 does not bear its ordinary technical meaning, nor can I find in the wording of the Claim any indication that it is confined to the particular kind of interlock which is described in detail in the body of the Specification and the drawings.

It is, in my view, quite impossible for any person skilled in the art and desiring
25 to instal a system for the remote operation of railway points or switches, to know whether he is or is not infringing the monopoly claimed by Claim 1. He cannot tell whether any particular type of interlock between the control relay and the signals is or is not within that monopoly. He cannot tell whether approach locking generally, or any particular type of approach locking, is or is not an
30 integer of the claim, and he is left in the dark as to the precise meaning of the words "if traffic conditions are adverse to such operation."

For these reasons, whether or not the proposed amendments are inserted in Claim 1 and even if I assume that a clear meaning can be given to the portion of Claim 1 which ends with the words "governing traffic over the switch," I am
35 of opinion that the Patentee has failed sufficiently and clearly to define the scope of the monopoly claimed in Claim 1. The result is that this action, so far as it is based on an alleged infringement of Claim 1, must fail.

There are two other matters to which I should refer before I leave Claim 1. One arises from a passage from the Plaintiffs' Amended Statement (already
40 quoted in this Judgment) which is in the following words: "The safe movement of traffic to and fro over a switch in any system involves numerous other well-recognised safeguards. Such safeguards are common knowledge in the art and their presence in any proper signalling system is regarded as essential for reasons of safety. All such safeguards are included by implication in the words
45 "a system for the remote operation of railway points or switches" and are not detailed in this statement." If it be true that the "numerous safeguards" there referred to were included by implication in the words "a system for the remote operation of railway points or switches," this would supply another element of uncertainty in Claim 1. In my view the evidence leaves it uncertain

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as to what these "numerous safeguards" are. See Mr. Wight's evidence on Day VII, page 31, line 2, to page 35, line 17. I see no reason for including anything by implication in the phrase which I have just quoted, but having regard to the view which I take of the other portions of Claim 1, it is unnecessary to discuss this matter further or to express any concluded opinion upon it. 5

The other matter is an argument which has been pressed by Mr. Heald on behalf of the Plaintiffs. He points out that there is no allegation in the Pleadings of insufficiency or inutility. That is to say, it is not alleged that the Complete Specification does not sufficiently and fairly describe and ascertain the nature of the invention and the manner in which the invention is to be performed, nor is it alleged that the invention is not useful. Therefore, says Mr. Heald, the Court starts with this, that a person skilled in the art, having read the Complete Specification, could without the exercise of any inventive faculty construct the apparatus for which a monopoly is claimed; and, further, that the apparatus so constructed would achieve a useful result. He says, further, that Claim 1 is a claim in which the monopoly claimed is defined by reference to the result. It follows, he says, that there can be no ambiguity in Claim 1, since it is in effect admitted on the Pleadings that anyone reading the Specification would be able, without the exercise of any inventive faculty, to produce an apparatus giving that result. 10 15 20

I think there are several answers to this argument. In the first place, Claim 1 is not, in my view, a claim in which the monopoly claimed is defined by reference to the result. I have already dealt with this point. In the second place, it is quite open to the Defendants to say, as they have said: Claim 1 has a clear meaning, and the meaning is that for which we have contended. If that meaning is accepted, there is no insufficiency and no inutility; but if that meaning is not accepted, the meaning is obscure and the claim is ambiguous. For this reason we have pleaded ambiguity in paragraph 3 of the Particulars of Objections. In the third place, in my view no defect of pleading (if there were any defect) would prevent the Court from holding that a claim was ambiguous, since it is the duty of a Patentee to state clearly and without ambiguity the scope of the monopoly which he claims. See the observations of Lord Parker in *Natural Colour Kinematograph Co. Ltd. v. Bioschemes, Ltd.*, 32 Reports of Patent Cases, page 256, at page 269, lines 9 to 13: "It is open to the Court to conclude that the terms of a specification are so ambiguous that its proper construction must 25 30 35
"always remain a matter of doubt, and in such a case, even if the specification
"had been prepared in perfect good faith, the duty of the Court would be to
"declare the patent void."

I now turn to Claim 2, and I can deal with this claim in its original form quite briefly, as Mr. Heald and Mr. Graham have frankly admitted that the original claim is open to grave objections. One objection is stated in the Plaintiffs' Supplemental Statement in the following terms: "As the claim originally stood 40
"it might have been held to cover the case in which no provision was made for
"preventing operation of the switch machine if traffic conditions were adverse
"thereto." I prefer to say that the claim would cover cases in which no provision is made for preventing the operation of the switch machine under any 45
circumstances; thus the monopoly claimed is wider than the alleged invention. I think, further, that Sir Stafford Cripps and Mr. Swan are right when they say that this claim is anticipated by *Bushnell's* Patent. It is arguable that the Claim

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is also anticipated by *McCready's* book; but my own view is that on its true construction the Claim does not cover a case in which mechanical or electrical interlocking is applied to the levers in the signal box. It is unnecessary to state my reasons for this view, as I feel no doubt that the Claim cannot be upheld. I think there are also strong grounds for contending that the last four lines of this claim give rise to ambiguity. But this also is a matter which it is unnecessary for me to discuss. I entertain no doubt that Claim 2 in its original form is not a claim which can be upheld.

I think, however, that before I pass from this Claim and consider the proposed amendment thereof, I ought to express my views as to the true construction of certain phrases in the Claim which have given rise to much argument. I shall first read the Claim and then state the questions which have been discussed and the views which I hold on these questions. My reasons for holding these views will be stated very briefly.

Claim 2 is as follows: "The combination of a railway switch, a power operated switch machine controlled from a distant control office by a relay adjacent the switch for operating said switch and signals governing the traffic over the switch which are controlled automatically in accordance with traffic conditions and by said relay, the control of the relay being such that the signals may be operated from the control office to give indications not more favourable than actual traffic conditions."

The first question is: ought the words "for operating the said switch and signals governing the traffic over the switch" be read together so that the word "operating" governs the word "signals," or ought the word "operating" to be read as governing only "the said switch," the signals being a separate integer? In my view the latter is the correct construction. I think that the integers of the Claim are as follows: (1) a railway switch; (2) a power operated switch machine for operating the said switch, such switch machine being controlled from a distant control office by a relay adjacent the switch; (3) signals governing the traffic over the switch which are controlled automatically in accordance with traffic conditions and by said relay; (4) the control of the relay being such that the signals may be operated from the control office to give indications not more favourable than actual traffic conditions. In my view, the words "the control of the relay" mean the control exercised by the relay. I think this is the more natural meaning, having regard to the fact that the immediately preceding part of the claim states that the signals, as well as being controlled automatically in accordance with traffic conditions, are controlled by the relay. It seems to me that one would naturally expect the words which immediately follow to be an explanation of the manner in which, or the extent to which, the relay controls the signals. Further, I think that throughout this Claim a distinction is drawn between operation and control, and it is pointed out, in the last four lines of the claim, that while the signals may be operated from the control office there is interposed a control by the relay which prevents the signals from being so operated as to give indications more favourable than actual traffic conditions.

Returning to the earlier part of the Claim, although it might be possible to read together the words "a relay adjacent the switch for operating the said switch and signals," I do not think that such a construction would be in accordance with the rest of the Specification, nor do I think that it would

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accurately describe the function of the relay. That which operates the switch is the switch machine, and I think it is unlikely that the Patentee would speak of the relay as operating the signals when he goes on immediately afterwards to say that the signals are controlled by the relay.

Having construed Claims 1 and 2 in their original form and having expressed 5 the view that neither of these Claims is valid, I have answered the first two of the four questions which I set out in an early part of this Judgment.

I must now answer the third question, which I shall restate: Ought I to allow, in the exercise of my discretion, (a) the amendments shown in red ink, (b) the amendments shown in green ink, and, if so, to what extent and upon 10 what terms?

I turn first to the proposed red ink amendment to Claim 2, as it is by far the most important of the amendments. It is desired to strike out the whole of Claim 2 and to substitute for it a claim in the following words: "The combination of a railway switch, a stretch of track which includes the switch, 15 " a power operated switch machine, two or more signals under combined automatic control and manual control from a remote control office which are " situated at one end of the stretch of track for governing traffic over the " switch in one direction and are interlocked by means of line circuits with " one or more opposing signals also under automatic control and under 20 " independent manual control which is or are situated at the other end of the " stretch of track for governing traffic over the switch in the other direction, " a relay adjacent the switch controlling the switch machine and the signals " governing traffic over the switch, manual means at the remote control office " for actuating the relay, means whereby the control exercised by the relay 25 " is limited automatically in accordance with traffic conditions, the combination being such that (1) notwithstanding the operation of the manual means " at the remote control office for actuating the relay, the operation of the " switch is prevented if traffic conditions are adverse to such operation; (2) the " signals may be operated to give indications not more favourable than is 30 " warranted by traffic conditions."

Counsel for the Defendants have advanced many reasons why I should refuse to allow this amendment. I do not propose to prolong an already lengthy Judgment by stating all these reasons and expressing my views upon each 35 of them, because I think there is one very simple reason why I should not allow this amendment. If I am right in my view that the phrase "if traffic conditions " are adverse to such operation " is a phrase which gives rise to uncertainty and ambiguity, it would clearly be wrong for me to allow the insertion of an amended claim which not only contains this same phrase but uses this phrase 40 for describing the "combination" which is being claimed. The description of the "combination" also includes the phrase "not more favourable than " is warranted by traffic conditions," which occurred in slightly different words in the original Claim 2 and which inclined me to the view that that claim was ambiguous.

Even if I saw no other reason for refusing to allow this amendment (and 45 I am far from saying that I see no other reason) this seems to me, in itself, a good reason why I should refuse to allow the amendment, and I do refuse to allow it. I can well understand that a draftsman who took the view that there was no ambiguity in Claim 1 or Claim 2 would naturally reproduce the

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phrases to which I have referred. But I do not share this view, and I think that these phrases import ambiguity into the amended Claim 2 even if this Claim were otherwise free from objection.

The other amendments to which objection is taken are not of so much importance, having regard to the views which I have already expressed, but I shall deal briefly with each of them.

In their Supplemental Statement the Plaintiffs say, as to the amendments at page 2, line 88, page 4, line 77, and page 6, line 81: "These are amendments by way of explanation and their purpose is to refer more specifically to the traffic conditions which, as the Plaintiffs' evidence will show, would be recognised by the skilled reader of the specification as being matters to be taken into account, and to avoid the suggestion made in paragraph 12 of the Defendants' Statement, which in the Plaintiffs' submission is quite unfounded." I have already quoted paragraph 12 of the Defendants' Statement there referred to. The Defendants in their Supplemental Statement object to these amendments "on the ground that the purpose and effect of such proposed amendments are not to explain the specification, but to introduce into the specification new matter enabling an interpretation to be placed upon the claims different from that which the claims bear in their unamended form." Further, in reference to the proposed amendment on page 2, line 88, the Defendants deny that the position and movement of trains, switches and signals in the system are referred to in the art and in the Specification as "traffic conditions." The Defendants repeat in this regard the submissions made in paragraph 12 of their original Statement. Further, in reference to the proposed amendment on page 4, line 77, the Defendants deny that "the opposing signals 7 and 7^a" are signals governing traffic over the switch 208 within the meaning of the Claims of the unamended Specification and say that the words which precede the proposed insertion are quite clear and need no explanation. Further, in reference to the proposed amendment on page 6, line 81, the Defendants object to the statement as being an incomplete and inaccurate statement of the conditions which are adverse to the safe movement of the switch 208, as it takes no account of the presence of a train in the siding moving towards switch 208.

I do not propose to allow any of these amendments. The amendment at page 2, line 88, is in the following terms: "It is well understood in the art that in any satisfactory system for the regulation of railway traffic, switches and signals must be dependent for their safe operation upon the conditions existing in the system, that is to say, the position and movement of trains and of other switches and signals."

"The position and movement of trains, switches and signals in the system are referred to in the art and in this specification as 'traffic conditions,' and such conditions must be taken into account in connection with any given switch or signal in so far as they affect the safe operation of such switch or signal at any given moment according to the particular arrangement of track." This amendment is said to be inserted by way of explanation. I propose to disallow it because in my view it serves no useful purpose at all. It would indicate that the phrase "if traffic conditions are adverse" in Claim 1 does not refer only to the position of the signals governing traffic over the switch, but it gives no

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assistance in defining the exact meaning of that phrase. As to the amendment at page 4, line 77, which I do not propose to read, I am content to say that I agree with the Defendants' comments which I have already quoted as to this amendment.

The amendment at page 6, line 81, is in the following terms: "The traffic 5
" conditions which are adverse to the movement of the switch 208 are that any
" one of the signals 2, 2^a, 1 and 1^a at the switch is not at stop, that a train is
" present in the track section immediately adjacent the switch (fouling section),
" or that a train has entered the second section (approach section) extending in
" advance of the fouling section at a time when signal 3 was at clear." This 10
amendment is, I think, linked up with the amendment on page 2, line 88, which
I have already disallowed: I agree with the Defendants' criticism, already
quoted, upon this amendment, and I may add that this amendment does not
remove the ambiguity in Claim 1, for two reasons. In the first place, although 15
in the system described in the body of the Specification and in the drawings the
presence of a train in the fouling section or the entry of a train into the approach
section at a time when signal 3 was at clear would prevent the operation of the
switch, such operation is not prevented by any interlocking of the relay ZF^o
with the signals, but is prevented by other features of the system. In the second 20
place, Claim 1 is not limited to the typical arrangement or system which is
described in the body of the Specification and shown in the drawings, and, if
this amendment is an amendment by way of explanation, it is by way of explanation
only of this arrangement or system.

As to the proposed amendment at page 19, line 38, this was put forward in 25
the course of the trial, and therefore there are no written statements in regard to
the reasons for it and the objections to it. Certain objections were put forward
by Sir *Stafford Cripps* and Mr. *Swan*, but in my view there is no substance in
these objections. If I were to allow this amendment, it would not remove the
grounds on which I have held Claims 1 and 2 to be invalid. Moreover, I do not 30
read Claims 1 and 2 as extending to cover such a system or combination as is
described in this amendment. I do not think it necessary to state my reasons
for this view, having regard to the decisions at which I have arrived as to
Claims 1 and 2 and as to the other proposed amendments. It may be that in
view of these decisions the Plaintiffs will not desire to have this amendment 35
allowed. It may be, however, that the amendment may be of some use in regard
to the claims other than Claims 1 and 2, which have not been very fully
discussed in this case.

After the conclusion of my judgment, Counsel can state the Plaintiffs' wishes 40
in regard to this amendment, and I shall then consider whether I shall give
effect to these wishes and, if so, upon what terms.

Having regard to the views which I have already expressed, it is apparent that 45
this action must fail, and that the motion also fails, in substance. As there is
no counter-claim for revocation of the Patent, I might now regard my task as
being ended. But it is possible that some other Court might disagree with my
views as to the invalidity of Claims 1 and 2 and as to disallowing the amend-
ments. For this reason I think I shall be taking the right course, though it may
be a somewhat rash course, if I embark upon a brief description of the
Defendants' installation at Stanmore and express certain views on the issue of

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infringement. A great part of the evidence and of the speeches of Counsel has been devoted to the Defendants' installation and the issue of infringement, and I think it is my duty to deal with these matters to some extent in the hope that my observations may be of some assistance, rather than to pass them over in
5 complete silence.

The task of understanding the Defendants' installation, though it was a difficult one, was somewhat lightened by the agreement between the parties to which I shall shortly refer. This task, as well as the task of giving a description of the Defendants' installation, was also greatly lightened by the assistance of
10 Dr. D. M. Robinson, Ph.D., B.Sc., M.S., A.M.I.E.E., who has attended as Electrical Assessor since the ninth day of the trial. Dr. Robinson has been of great assistance in helping me to understand the complicated electrical circuits with which I have had to deal.

It was agreed between the parties, before the trial, that in dealing with the
15 Defendants' installation at Stanmore I should only consider switch No. 7^A and signals numbers 4R, 4LA, 4LB, 8LA and 8LB, all of which are conveniently shown on the large plan which is Exhibit D.5. There are other switches and signals at Stanmore, but it has been agreed that I shall disregard them for the purposes of my Judgment, and no evidence had been led with regard to them.
20 This was, in my view, a very sensible agreement, which has saved a good deal of time. For the purposes of this Judgment, therefore, I shall deal only with the switch and signals referred to above and the track which is coloured blue on sheet 2 of the Exhibit P.14. This switch and these signals and the traffic over the track which I have mentioned are all governed from a control panel situate
25 at Wembley Park, some $4\frac{1}{2}$ miles away.

It is common ground that the Defendants' installation is a system for the remote control of a railway switch and signals. The working of the installation was fully and clearly explained by Mr. Preston in his evidence (Day VIII, page 90, line 23, to Day X, page 58, line 22) and the installation is illustrated
30 in the Exhibits P.14, P.17, P.20, P.22, P.23 and D.5, while the principle of the Defendants' code system is illustrated in P.21. I shall refer later to certain particular features of the Defendants' installation, but I must now attempt to give a brief summary of the general nature of the installation, confining myself to the switch and signals mentioned above.

Referring to the left-hand side of sheet 2 of P.14, the lower track represents the "up" line to Wembley, while the upper track represents the "down" line. Since Stanmore is a terminus, a train which arrives from Wembley and stops at No. 1 platform on the right hand side of the diagram can only get out on to the "up" line to return to Wembley by passing over the switch 7^A in the
40 reverse position. Permission to start this journey is given by the starting signal 8LA. On the other hand, a train in platform 2 returns to Wembley over the switch 7^A in the normal position, and permission to start is given by the starting signal 8LB. It may on occasions be necessary to shunt a train out of platform No. 1 or platform No. 2 on to the "up" line. For this the switch 7^A must
45 again be in the reverse or normal position for platforms 1 or 2 respectively, but the shunting signal 4LA or 4 LB is used instead of the starting signal, and the

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driver then knows that he is to proceed only as far as a shunting board (not shown) placed 600 yards to the Wembley side of the signal 4R. The signal 4R is solely for the purpose of governing the return to Stanmore of trains which have shunted out to this position and is associated with a route indicator to show the driver whether the switch 7^A is set for him to enter platform 1 or platform 2. 5

These five signals are inter-related with each other, with the switch 7^A and with the relevant track circuits, by local interconnections in the field; that is to say, in the vicinity of the switch and signals, and the signals and switch are operated by means of levers in the signal cabin at Wembley. Separate line wires are not provided between the cabin and each unit in the field; instead, three common wires run throughout the system and the required unit is selected by means of a code. For the time being, I shall omit all description of this code system, treating it merely as a system of communication between the signal cabin and the field. It is sufficient to notice that this communication system terminates at each location in the field in a field storage unit, and for my present purposes I need only consider the field storage units XZYX and XZXY shown on the Exhibit D.5. These two units have been referred to throughout the case as "the Alpha unit" and "the Beta unit" respectively, and I shall so refer to them hereafter. The switch 7^A is operated by the switch lever 7 shown on the left hand side of the drawing D.5, via the field storage unit Alpha. The signals 8LA, 8LB are operated by signal lever No. 8 via the same unit Alpha. The signals 4R, 4LA, 4LB are operated by signal lever No. 4 via the Beta field storage unit. The signal levers have three positions. The two extreme positions clear the signals for movement over the switch to the left and the right respectively, while with the lever in the centre position both sets of signals are put to and held at stop. Of the two signal levers I have to consider, No. 4 lever operates signals for governing traffic over the switch 7^A in both directions, but No. 8 lever is only required to operate signals governing traffic towards Wembley, namely, the signals 8LA and 8LB. In the field storage unit Alpha, the relays 6YS and 6XS store, at any given time, the most recent order concerning the switch received from the signal cabin, while the relays 7YS and 7XS in the Alpha unit, and 7YS and 7XS in the Beta unit store the most recent orders concerning the signals in a similar way. For convenience I have referred to each of these pairs of interlocked relays as "relays," in the plural, but I do not intend thereby to express any view as to whether each pair is more accurately described as a relay or as two relays, a question as to which I heard much argument. The circuit of the relay 7S, shown in yellow, passes through a number of front contacts of other relays, and in this way all the possible inhibitions it is desired to have on the operation of the switch machine are collected at the relay 7S and prevent any change in the energisation of 6YS and 6XS, and hence prevent any movement of the switch, unless all the relevant track circuits are energised and all the signals giving access to the switch 7^A are at stop. To get the switch to operate, say, to normal, the chain of relays 7S, 6XS, 7NWR and switch machine motor relay must be energised, and the energisation of each of these depends on the energisation of that immediately preceding it. 45

Dealing now with the operation of the signals, to clear, for example, the signal 8LR the home relay for that signal, namely, the relay 8LBHR must be energised.

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Inhibitions on the energisation of this relay are provided as follows: by breaks at the front contacts of any of the relevant track relays which are de-energised, by the signal 4R not being at stop, by the switch machine not having completely operated, and by the relay 7NWR or the relay 6XS being de-energised. Provided none of these inhibitions is active, the circuit of the relay 8LBHR can be completed and the signal 8LB cleared by the operation of the signal lever No. 8. The chain of relays in this case is 7XS in the Alpha unit, 8LHS and 8LBHS.

I must now give some description of the Defendants' coding system. Communication for the purposes of railway signalling and switch operation involves the conveying of an idea to a selected point. In the Defendants' system the ideas to be conveyed are: switch normal or switch reverse, signals clear for movement to the left, signals clear for movement to the right, or signals all at stop. The conveying is done electrically, and, to avoid the large number of line wires which would have to be provided if a separate wire were provided for each unit in the field, the Defendants use two conveying circuits which are common to the whole system. Thus all orders are conveyed to the field coding unit in the field, but each field storage unit has what may conveniently be referred to as a "call-sign" allotted to it and includes apparatus which will select any idea or order which is prefaced by its own call-sign, but will ignore all orders prefaced by other call-signs. In this way the idea is conveyed only to the selected field storage unit.

Apparatus which is to operate on receipt, for example, of the letters CAT, but is to ignore the call TAC and the other four possible permutations, must obviously be sensitive not only to the letters but to their sequence. In the Defendants' installation this result is achieved in the following manner. Each idea destined for a selected field storage unit is conveyed by one of a group of eight impulses, the function of each of these impulses depending on its position in the group. Thus the sixth impulse relates to the switch and the seventh to the signals. Four of these impulses, constituting what I have referred to as the call-sign, release, as it were, the combination lock giving access to the selected field storage unit, and allow the two orders relating respectively to the switch and the signals at that station to proceed to their respective destinations.

The Defendants' signal lever sends one of three orders by breaking one of two circuits or both together, while the switch lever sends one of two orders in the same way. The steps of the call-sign also consist of breaks in these circuits; at each step any one of three different signals may be sent. As there are four steps in the call-sign, the number of field storage units on the system could be as high as $3 \times 3 \times 3 \times 3 = 81$.

In the present case I am only concerned with two field storage units, the Alpha unit and the Beta unit. If the signalman wishes to put the switch 7^A to normal and then clear the signal 8LB, he moves lever 7 and lever 8 to the appropriate positions and presses the starting button below them. This sets in operation a series of stepping relays in the office coding unit, and the office line unit is then caused to send out the appropriate series of X, Y and Z impulses along the common conveying circuits. These impulses are received by the field line unit and passed on to the field coding unit, whence those impulses, corresponding to the orders to switch and signals, are directed by means of the station deter-

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mining relays S D to the appropriate field storage unit, in this case Alpha. I have already outlined the process of operation from the field storage unit on to the switch or signal, and shall not repeat it here.

I propose now to deal, as briefly as I can, with one aspect of the issue of infringement. I think it would be a waste of time if I considered Claim 2 in this connection. It was not seriously contended that Claim 2 can be upheld in its original form, and I do not think I should serve any useful purpose by considering whether the Defendants have infringed Claim 2 in its amended form, on the hypothesis that the amendment is allowed. I propose, however, to assume that another Court finds itself able to put some clear meaning on the latter portion of Claim 1, beginning with the words "and being interlocked," and upholds the validity of Claim 1.

If the construction put upon these words were that put forward by the Defendants (and it must be borne in mind that this construction would prevent signals 7 and 7ⁿ from being included within the words "such signals") I think that the Plaintiffs are on the horns of a dilemma. In order to establish that Claim 1 had subject-matter, having regard to *Bushnell's* Patent and the common general knowledge on 6th August, 1925, they would have to rely upon the reduction of the number of relays employed by *Bushnell* from two to one and the use of only one line wire and a return. If they did so, they would obviously have to contend that these two features were essential features of the invention claimed in Claim 1. But if they successfully so contended, they could not establish infringement, since, even if the Court could be persuaded that 6XS and 6YS answer the description of a "relay" in Claim 1, it is quite clear that the Defendants do not use only a single line wire and a return, and this would, *ex hypothesi*, be an essential feature of Claim 1.

I now assume that the Defendants' construction of the words in question is not accepted, but some other clear meaning is given to the words in question. Whatever that meaning may be, I do not see how the Defendants have infringed Claim 1. In my view the Defendants' installation does not answer the earlier part of the description of the invention in Claim 1. I shall go through this portion of the Claim without considering for the moment whether the Defendants have used equivalents for any of the integers. The Defendants' installation is clearly "a system for the remote operation of railway points or switches "having power operated switch machines." In the Defendants' installation one finds manually controlled means at a control office for each remotely operated switch. But I must now consider (a) whether the manually controlled means are arranged to control the operation of "a relay adjacent the switch"; (b) whether the relay is controlled "over a single line wire and a return wire (or an earth return)"; (c) whether the said relay "controls the switch machine and the signals governing traffic over the switch."

In considering these questions I must bear in mind the principle stated by Mr. Justice *Romer* in *Nobels' Explosives Co., Ltd. v. Anderson* (11 Reports of Patent Cases, page 115, at page 128, line 2) as follows: "In order to "make out infringement, it must be established that the alleged infringer, "dealing with what he is doing as a matter of substance, is taking the invention claimed; not the invention which the Patentee might have claimed if

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"he had been well advised or bolder, but that which he has in fact and substance
"claimed on a fair construction."

As to question (a), I turn first to column 4 on page 3 of the Plaintiffs' Statement, which is headed "Parts or combinations of parts in Defendants' C.T.C. installation alleged to infringe respective claims," and opposite integer 5, which is "Relay adjacent the switch," I find this: "Relays 6X, 6Y and associated circuits including relays 6XS, 6YS in storage units XZYX, 'XZXY.'" But in a letter of the 22nd of October, 1938, from the Plaintiffs' solicitors to the Defendants' solicitors, the former say: "We therefore ask you
10 "to note that the Plaintiffs intend in the first instance to rely upon the relays
"6XS and 6YS in storage unit XZYX" (this is the unit which has been referred to throughout the case as the "Alpha unit") "as being or being
"equivalent to the 'relay adjacent the switch.' The Plaintiffs do, however,
"reserve the right, if the above contention is not accepted, to contend in the
15 "alternative that the Defendants' system employs a plurality of relays which
"constitutes an equivalent of the 'relay adjacent the switch.'" I do not propose at this stage of my Judgment to discuss the question whether 6XS and 6YS in the Alpha unit are properly described as "a relay" or are identifiable with the "relay adjacent the switch" mentioned in Claim 1. I shall
20 assume that they are, without expressing any opinion on the point. But I cannot refrain from adding that the identification is difficult, having regard to the evidence, and in particular to the evidence of Mr. Preston, Day X, page 74, line 22, to page 75, line 21, and Day XI, page 2, lines 3 to 25.

As to question (b) it is quite plain that 6XS and 6YS are not controlled over
25 a single line wire and a return. The Plaintiffs did not contend the contrary at the trial, but relied on the alternative contention which is set out in the fourth column on page 5 of their Statement in these words: "In the alternative, if
"it is held that the Defendants' system does not fall within the strict wording
"of Claim 1 by reason of the fact that the Defendants have added a code
30 "arrangement involving the use of a third wire, the Plaintiffs will contend that
"such a system constitutes an equivalent of the system claimed." Again I assume, in order to avoid a discussion of the point which would necessarily be lengthy, that this contention is well founded; but I must not be taken as acceding to it.

As to question (c), I think that the Plaintiffs get into hopeless difficulties on
35 this point, even on the assumptions made above. In order to establish infringement of this integer of Claim 1, they have to establish that in the Defendants' system "said relay"—that is, *ex hypothesi*, 6XS, 6YS in the Alpha unit—controls the switch machine and the signals governing traffic over the switch.
40 In my opinion they have wholly failed to establish this. In my view, "control" in this context must include the ability to put a signal to stop. In this sense, in the system described in the drawings attached to the Patent in suit the relay ZF^o controls signals 2, 2^d, 1 and 1^s, and no others, while in the Defendants' system 6XS, 6YS in the Alpha unit do not control any signal. Mr. Preston
45 (Day XI, page 11, line 19) was asked this question: "That faculty (i.e. the
"ability to put the signals to stop) is only provided in the Defendants' (system)
"by the operation of the relay 7YS and 7XS in the field storage units?—

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" (A.) Yes. (Q.) In the Plaintiffs' it is provided by the relay ZF?—(A.) Yes." As 6XS 6YS do not, in my view, control any signal, and as the switch and signals are controlled in the Defendants' system by a number of pairs of relays, I do not think the Plaintiffs can possibly identify 6XS 6YS, or any other pair of interlocked relays, as being the " relay controlling the switch machine and 5
" the signals " which is mentioned in Claim 1, even if they satisfied the Court that 6XS 6YS were " a relay " within the meaning of Claim 1.

I resist the temptation to discuss the subject of equivalents at this stage. I shall merely say that in my view, in the present case, the Plaintiffs could not establish that the Defendants have infringed, by the use of equivalents or otherwise, the integers of Claim 1 which I have mentioned in questions (a), (b) and 10
(c) above.

I think I ought to say a few words about the evidence, and in particular the evidence of Mr. *Wight*, for the assistance of any other Court which may have to consider this case. Mr. *Wight* was, in my view, an essentially honest man, but 15
he found himself at times, during his cross-examination, in a most embarrassing position. As an honest man, he desired to give truthful and accurate answers, but as the inventor of the system described in the body of the specification and the drawings attached thereto, he was naturally reluctant to make any admissions which might cast doubts on the validity of the Patent in suit. He pondered long 20
before answering many of the questions asked in cross-examination, and in my view, he was often considering, not only what was the correct answer to the question, but what was the purpose of the question and in what direction was the question leading him. Further, as appears from the transcript of his evidence, Mr. *Wight* frequently failed, in the first instance, to answer the question which 25
was put to him. Sometimes, I think, he genuinely misunderstood the question. Sometimes, I think, he understood it quite well, but was desirous of gaining time.

Subject to these comments in the case of Mr. *Wight*, I have nothing but praise for the manner in which Mr. *Wight* and the other witnesses gave their evidence, 30
and I add this comment that, in my view, none of the admissions made by the witnesses were made incautiously. All the witnesses gave their evidence in a careful and thoughtful manner.

The result is that the action fails, and the motion asking for liberty to amend also fails. My present view is that the Plaintiffs ought to pay the Defendants' 35
costs of the action and the motion, as well as the costs of the *Comptroller* which they have already agreed to pay; but I shall hear any submissions which Mr. *Heald* may desire to make as to costs, and I shall also hear him as to whether the Plaintiffs desire me to allow the amendment on page 19 of the specification at line 38. 40

Cripps K.C.—I have to ask your Lordships first of all to grant a certificate as regards the Particulars of Objections. As regards Claims 1 and 2, for *Bushnell*, *McCreedy*, *Anderson* and the *Ashington Colliery*. Those were the four matters your Lordship mentioned in your Judgment.

Morton J.—Mr. *Heald*, do you raise any objection to that certificate?

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Heald K.C.—Yes, my Lord; I object to Ashington. Ashington was the document which was in favour of the Plaintiffs in so far as there was anything in it.

Cripps K.C.—It does not matter in whose favour it was; the question is whether it was of assistance to your Lordship in arriving at the decision. One very
5 common test is whether the learned Judge refers to it in his Judgment.

Morton J.—I did consider Ashington and described it in my Judgment, I did not think Ashington was an anticipation. Which is the section or rule?

Cripps K.C.—Order LIIIA, Rule 20.

Heald K.C.—My Lord, whether it is a small matter or not, I think it should
10 be dealt with in the proper way.

Morton J.—Mr. *Heald*, my present view is that I ought to grant a certificate as to Ashington.

Cripps K.C.—As to the whole of the rest of them I am going to ask for a certificate on the basis of the letter. My learned friend's clients agreed to pay
15 our costs up to the date of the letter as regards all the Particulars of Objections to the other claims—3, 4, 5, 6, and so on. When they said they would not go on with the other claims we said we would not attack the validity of them if they did not go on with them on infringement. That is why they came to be struck out from your Lordships' consideration. I am asking as a matter of formality,
20 for a certificate as to all the rest of the Objections for that purpose, otherwise they could not be taxed. Would your Lordship allow us to have Minutes of Order upon costs?

Morton J.—Certainly; there shall be agreed Minutes of Order.

Heald K.C.—And a certificate so far as necessary, in order to give effect to the
25 agreement?

Morton J.—Yes.

Cripps K.C.—There are two other matters. The first is: will your Lordship certify for three Counsel?

Morton J.—Yes, I think that is quite reasonable.

Cripps K.C.—Then in this case I ask your Lordship to certify for costs on the
30 higher scale.

Heald K.C.—The matter is entirely in your Lordship's hands. There are various cases in which various Orders have been made. Lord *Parker*, then Mr. Justice *Parker*, in the case of *Marconi v. British Radio*, to which your Lordship referred on the question of equivalence, said that he had allowed costs on the
35 higher scale in chemical cases, but not in engineering or electrical cases. I do not know of any case of this character in which they have been given. There has been a number of cases in recent years, some of which were of very great com-

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plication—the wireless cases, for example, some of which lasted for very nearly as long as this one. In none of those cases, as far as I know, has such an Order been made.

Morton J.—My view is that this is a case in which, in view of the great difficulty in preparing for trial and the complexity of the matters which were 5 involved, I ought to give costs on the higher scale.

Cripps K.C.—If your Lordship pleases. Then we may draw up Minutes of Order, and if necessary come back to your Lordship if we are in difficulty about it.

Morton J.—Yes; if there is any difficulty you may mention it to me, with 10 notice to the other side. Mr. *Heald*, do you wish me to allow the amendment on page 19?

Heald K.C.—I think the position is this: it might be that the Plaintiffs would be advised to take the opportunity of making an application for some other amendment. In those circumstances I think it would probably be very much 15 better to leave the question of amendment entirely alone so far as substantive amendments are concerned, and simply ask your Lordship, as I understand has already been agreed, that the formal and minor amendments should be allowed, leaving the other questions entirely alone, particularly as your Lordship said that in your Lordship's view it was doubtful whether such an amendment was 20 required at all.

Morton J.—Yes; but I think, the amendment having been put forward, the Order must either allow it or disallow it. My own view is that it is unnecessary, but harmless.

Heald K.C.—May we consider that in connection with the Order and mention 25 it to your Lordship?

Morton J.—Certainly.

On the 27th of February, 1939, Minutes of Order were submitted to his Lordship and approved as follows:—

Swan K.C.—If your Lordship pleases, my learned friend Mr. *Graham* and I 30 have drafted Minutes of Order pursuant to your Lordship's judgment in this action, and we now submit them for your Lordship's approval. They are agreed, subject to one point which occurs in the preamble that I ought, perhaps, to mention to your Lordship. In the first place, this Order deals both with your Lordship's directions as regards amendment of the Specification and with the 35 substantive action, as the application to amend was by Motion in the action.

Perhaps I might begin reading the Minutes at the seventh line: " Upon reading 40 " the Pleadings and Statements filed on behalf of the Plaintiffs and Defendants, " and certain agreements come to between the Plaintiffs' and Defendants' " solicitors embodied in letters dated the 21st and 25th October, 1938, and " upon reading an Order of Mr. Justice *Simonds* dated the 25th day of March, " 1938, upon motion of the Plaintiffs herein for leave to amend the Complete

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" Specification of their Letters Patent No. 268,822 and upon the Plaintiffs
" applying at the trial to amend the Complete Specification of the said Letters
" Patent as indicated in purple ink on the copy of the same attached hereto "—
if I may pause there for a moment to explain, your Lordship will remember that
5 the original amendments were made in red. Then there were subsequent
amendments before the trial made in green. Your Lordship will observe that in
Claims 4, 5 and 6 the green ink cancelled the red, and so restored that particular
passage to the printed position.

Graham.—That was as the result of certain agreements between the parties.

10 *Swan K.C.*—My learned friend and I both thought it would be confusing,
where you had an amendment itself amended in such a way that it cancelled the
original amendment, to leave it in that form. Therefore, we have annexed to
the Order a specification in which all the amendments which were actually
applied for at the trial are indicated in purple ink, and that, of course, omits
15 those amendments which appear on the specification as red amendments
cancelled by green " and upon hearing the evidence and arguments of Counsel
" for the Plaintiffs and for the Defendants and upon the Plaintiffs by leave of
" the Court withdrawing their application to amend the said Specification as
" shown in purple ink on page 19 at line 38 without prejudice to their right to
20 " apply hereafter for the same or a similar amendment and this Court having
" found, *inter alia*, that Claims 1 and 2 of the said Letters Patent are invalid
" and the Plaintiffs admitting for the purpose of this action that Claim 3 of the
" said Letters Patent is also invalid in consequence of such finding " that was
a matter of agreement on the correspondence; the Plaintiffs were willing that
25 Claim 3 in its amended form should stand or fall by the fate of Claims 1 and 2.
" This Court doth order that this action do stand dismissed out of this Court
" with costs on the higher scale to be taxed by the Taxing Master and paid by
" the Plaintiffs to the Defendants such costs to include (a) the costs of three
" Counsel; (b) the costs incurred by the Defendants in the preparation of their
30 " defence to the allegation of infringement of Claims 3, 4, 5 and 6 of the
" Plaintiffs' Patent No. 268,822 and (c) the costs incurred by the Defendants
" in their attack upon the validity of the said Claims and in the delivery of
" amended Statements consequent upon the subsequent abandonment by the
" Plaintiffs of their allegation that the said claims had been infringed.
35 " And this Court certifies that as against Claims 1 and 2 of the Plaintiffs' said
" Letters Patent, paragraph 1 of the amended Particulars of Objections (in so
" far as the same relates to *Bushnell's* Specification and the Books of *McCready*
" and *Anderson*, and the prior user at *Ashington Colliery*, and paragraphs 2
" and 3 of the amended Particulars of Objections "—paragraph 2 went as to
40 subject-matter and paragraph 3 as to the content of the Claims—" were reason-
" able and proper and as against Claims 3 to 6 inclusive that paragraphs 1, 2
" and 3 with the exception of the citation of *Siemens, Zabel* and *Harlow's* two
" Specifications, were reasonable and proper, and this Court doth grant liberty
" to the Plaintiffs to amend the Complete Specification of their said Letters
45 " Patent by making therein the amendments applied for, with the exception of
" the amendments set forth in the Schedule hereto without prejudice to the right
" of the Plaintiffs to apply hereafter for the above-mentioned amendment on
" page 19, line 38." It is more usual to schedule the amendments allowed than

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to schedule the amendments refused, but in this case the amendments allowed were very many and very small—here and there a word or a numeral—and it was found more convenient to schedule the amendments refused than the amendments allowed in this particular case. “ And this Court doth order that the costs
“ of and occasioned by the said motion for liberty to amend the said Specifica- 5
“ tion be taxed as costs in the action and be paid by the Plaintiffs to the
“ Defendants. And that the Plaintiffs do pay to the *Comptroller-General of*
“ *Patents* the agreed sum of £3 3s. in respect of his costs.” Then follows the schedule of amendments refused.

Morton J.—That seems completely in order, subject only to the point about the 10
purple ink. I think that the Minutes are in a most convenient form, but if the
matter goes elsewhere there ought to be supplied with the judgment a copy of
the Specification amended in red and in green, as it was before me.