Sept. 25, 1951 E. M. S. McWHIRTER ET AL 2,568,756

RESERVATION SYSTEM

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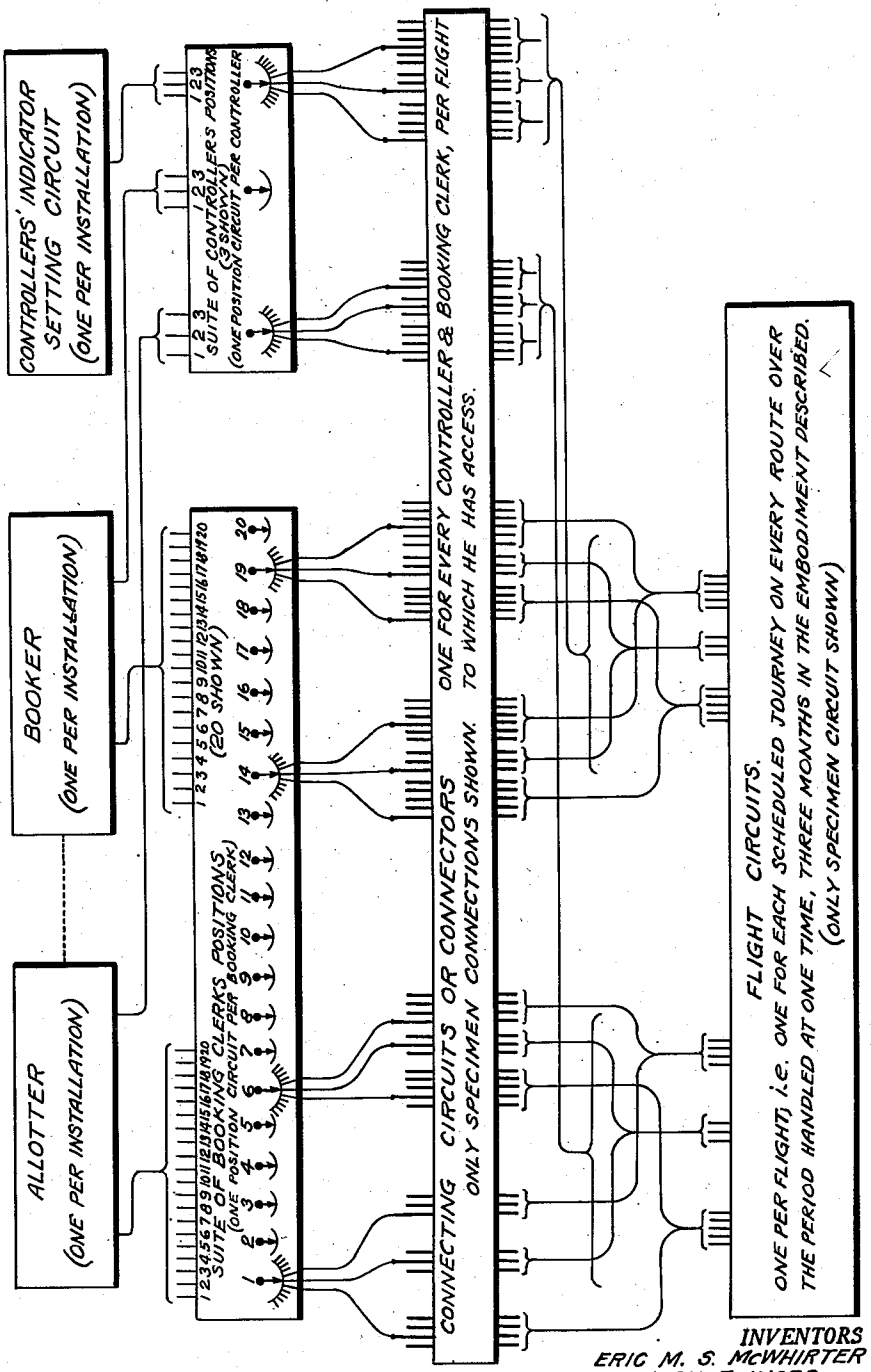


Fig. 1.

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BY Robert Harding Jr

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Sept. 25, 1951 E. M. S. McWHIRTER ET AL 2,568,756

RESERVATION SYSTEM

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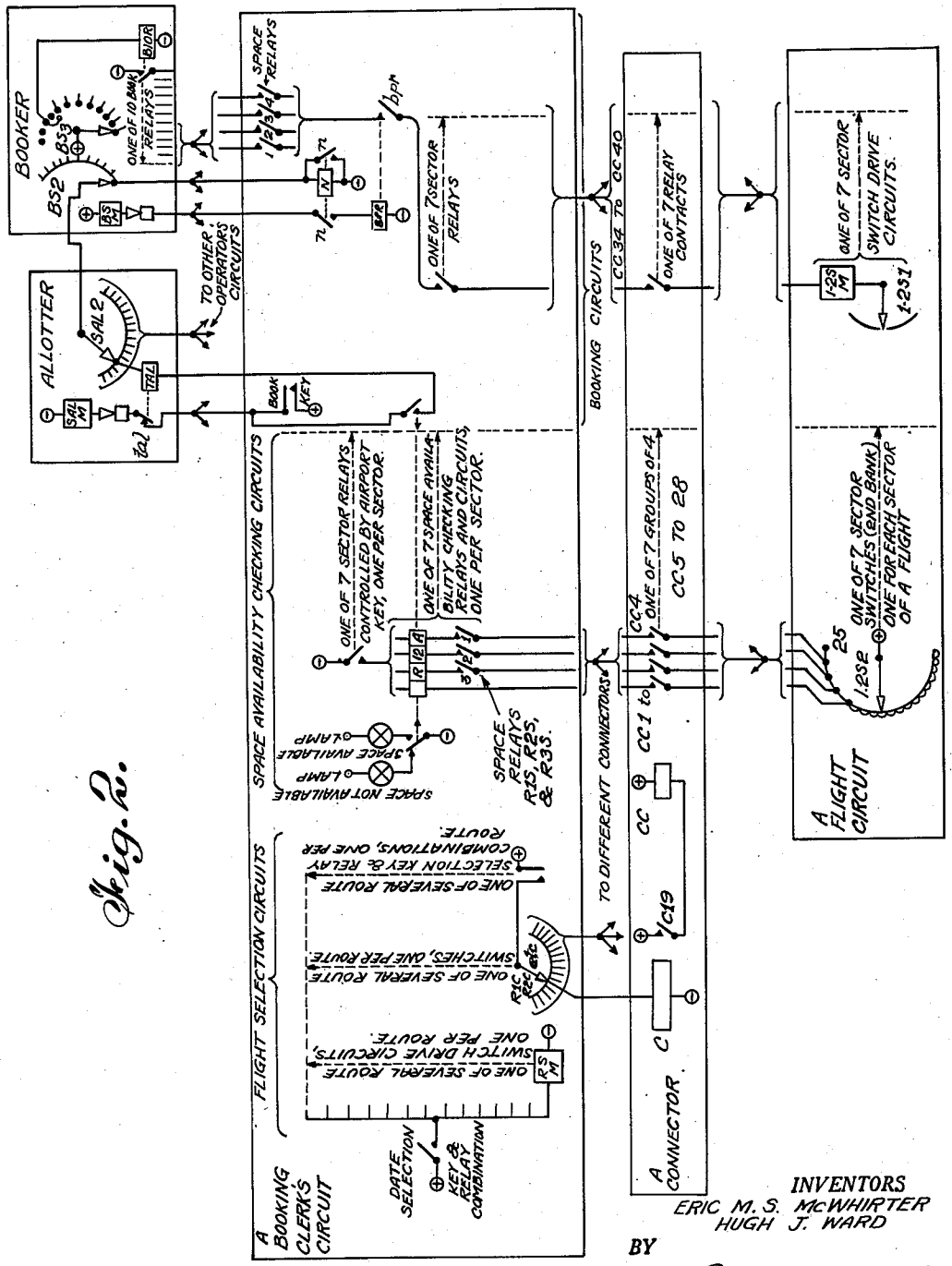


Fig. 2.

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RESERVATION SYSTEM

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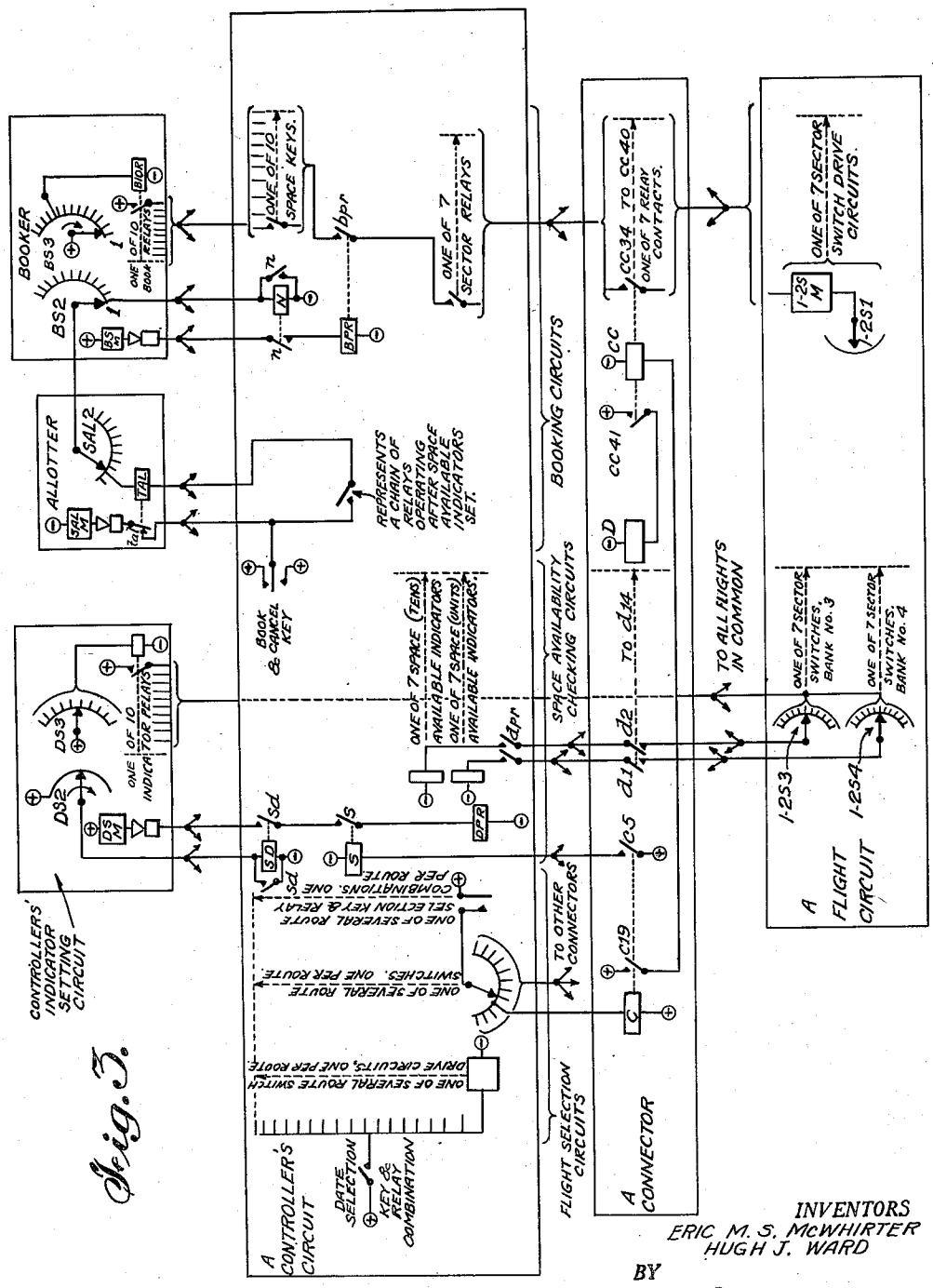


Fig. 3.

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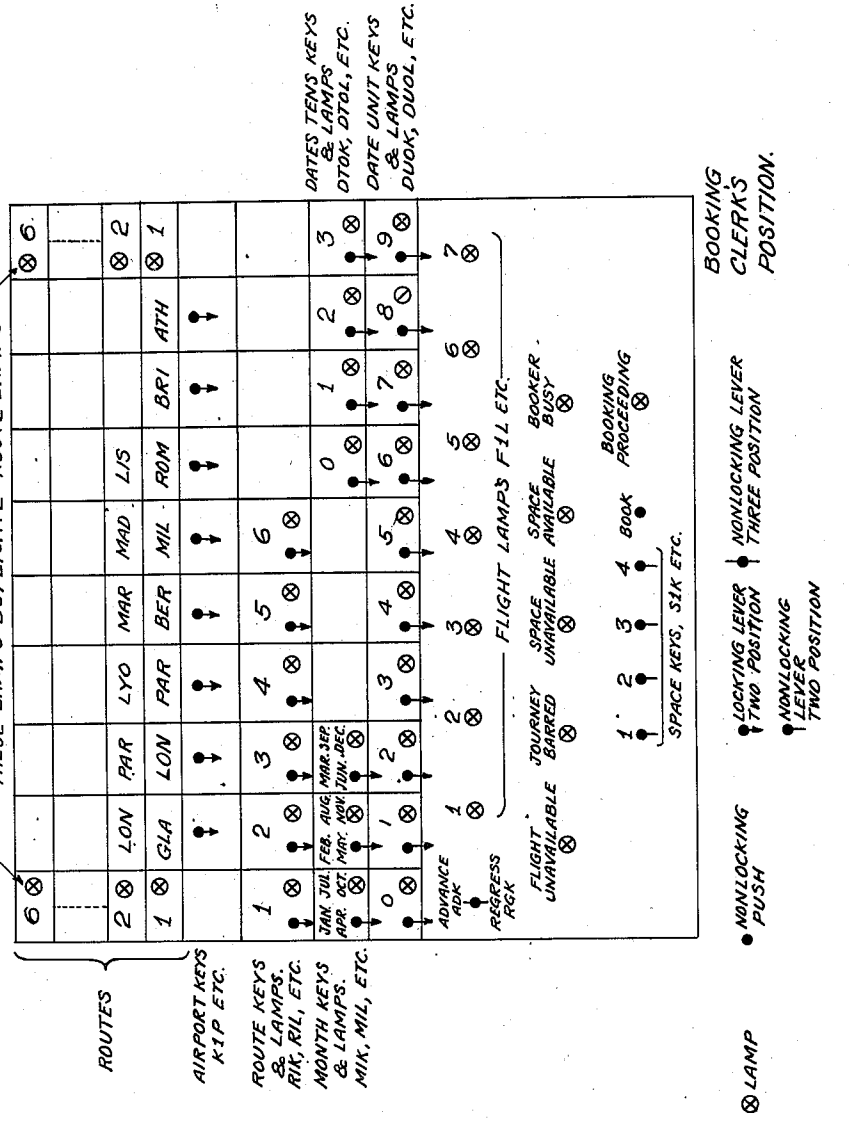
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Sept. 25, 1951 E. M. S. McWHIRTER ET AL 2,568,756

RESERVATION SYSTEM

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Fig. 4.



INVENTORS
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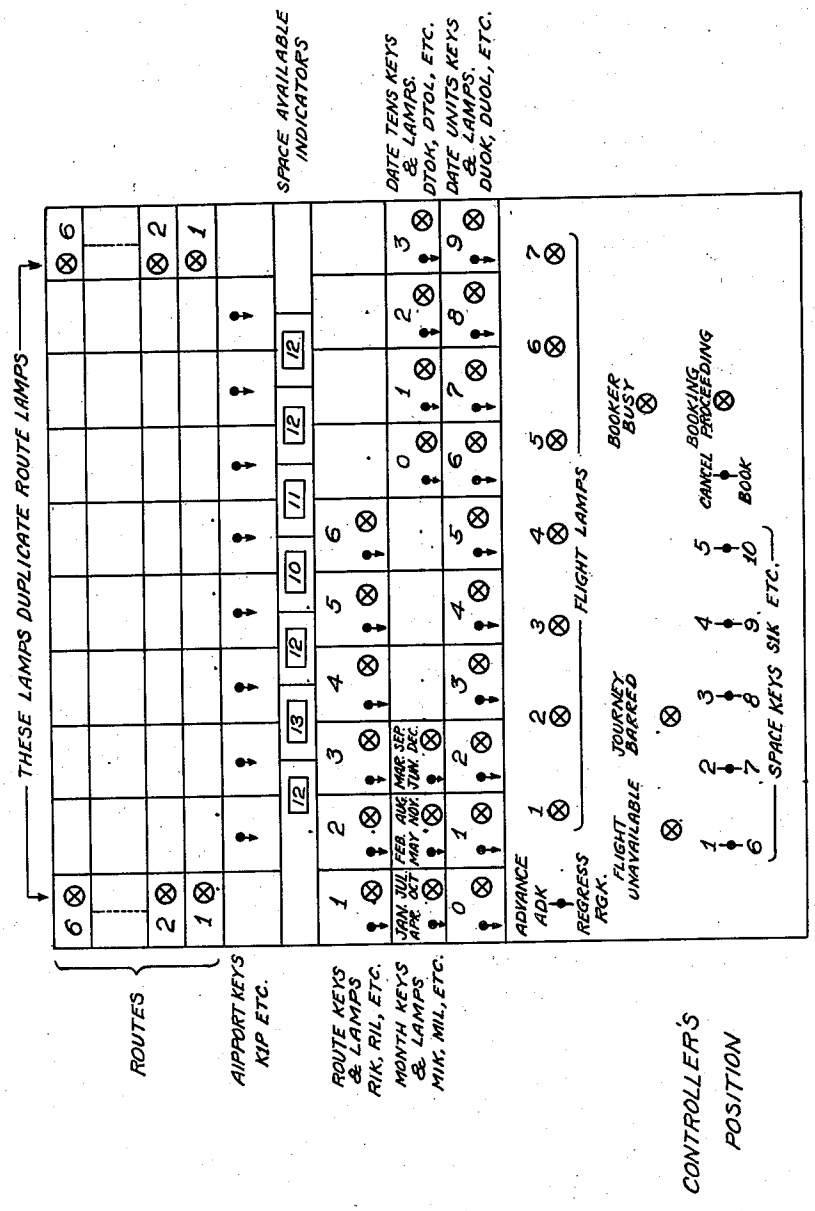
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Sept. 25, 1951 E. M. S. McWHIRTER ET AL 2,568,756

RESERVATION SYSTEM

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Fig. 5.



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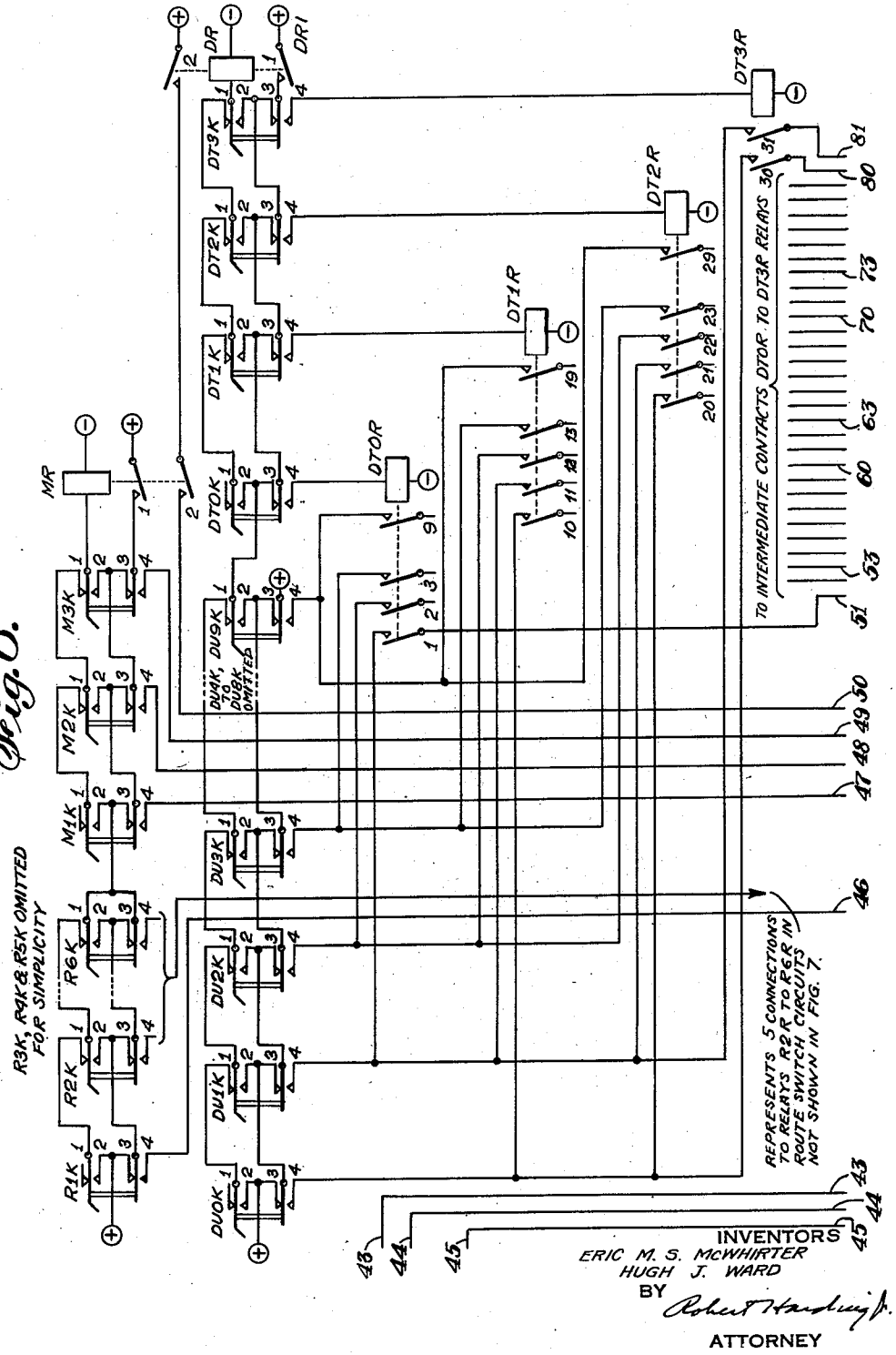


Fig. 6.

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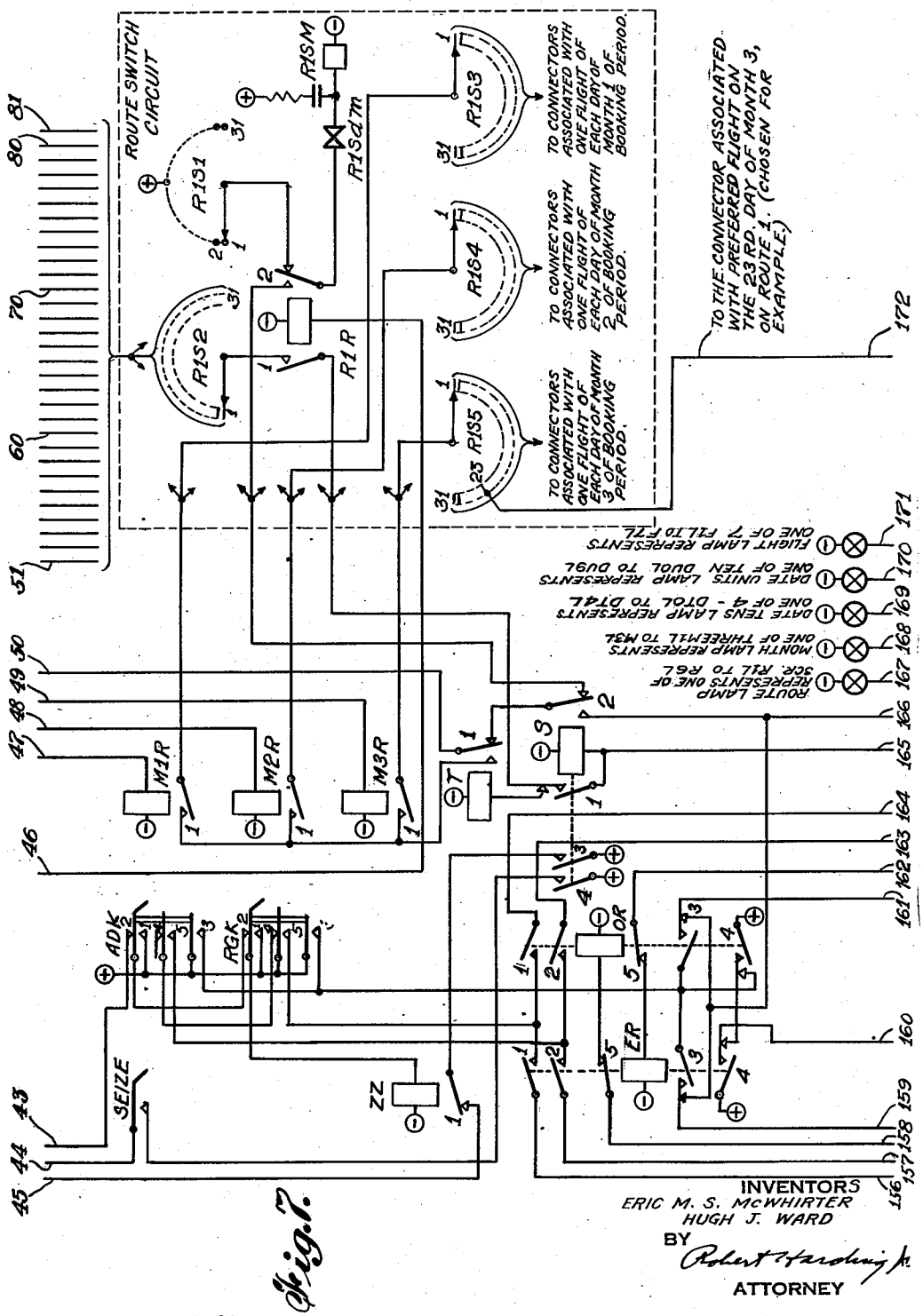


Fig. 7.

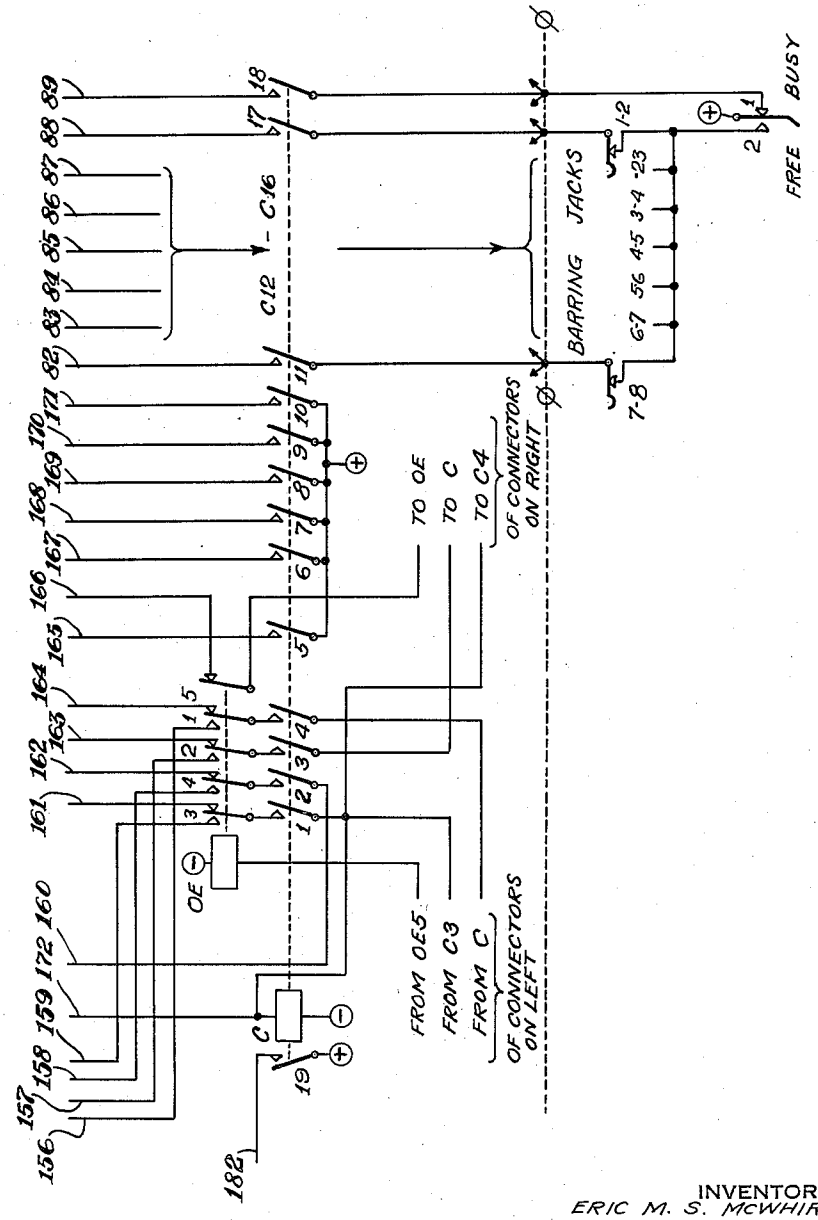
INVENTORS
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RESERVATION SYSTEM

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Fig. 8.



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RESERVATION SYSTEM

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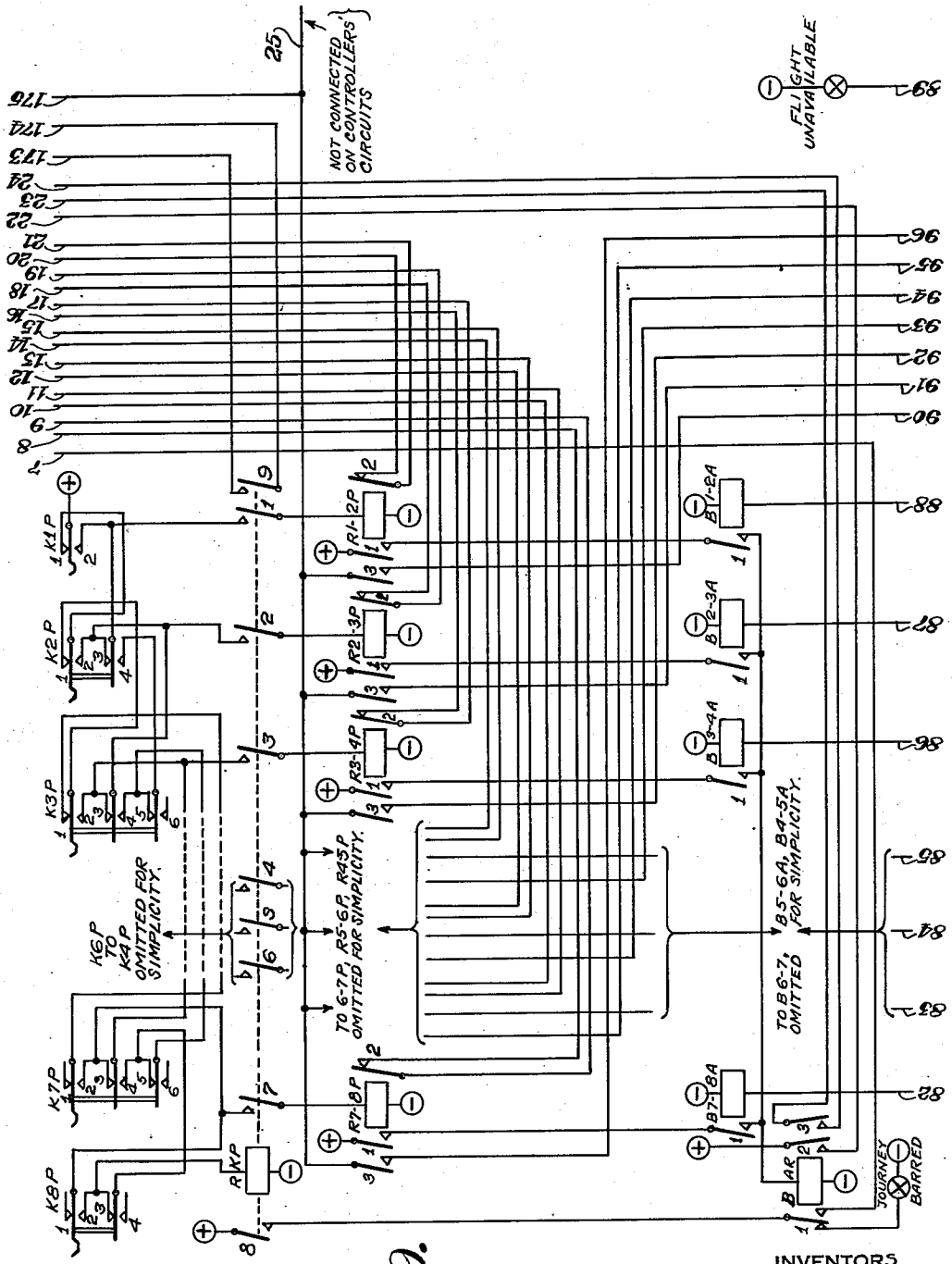


Fig. 9.

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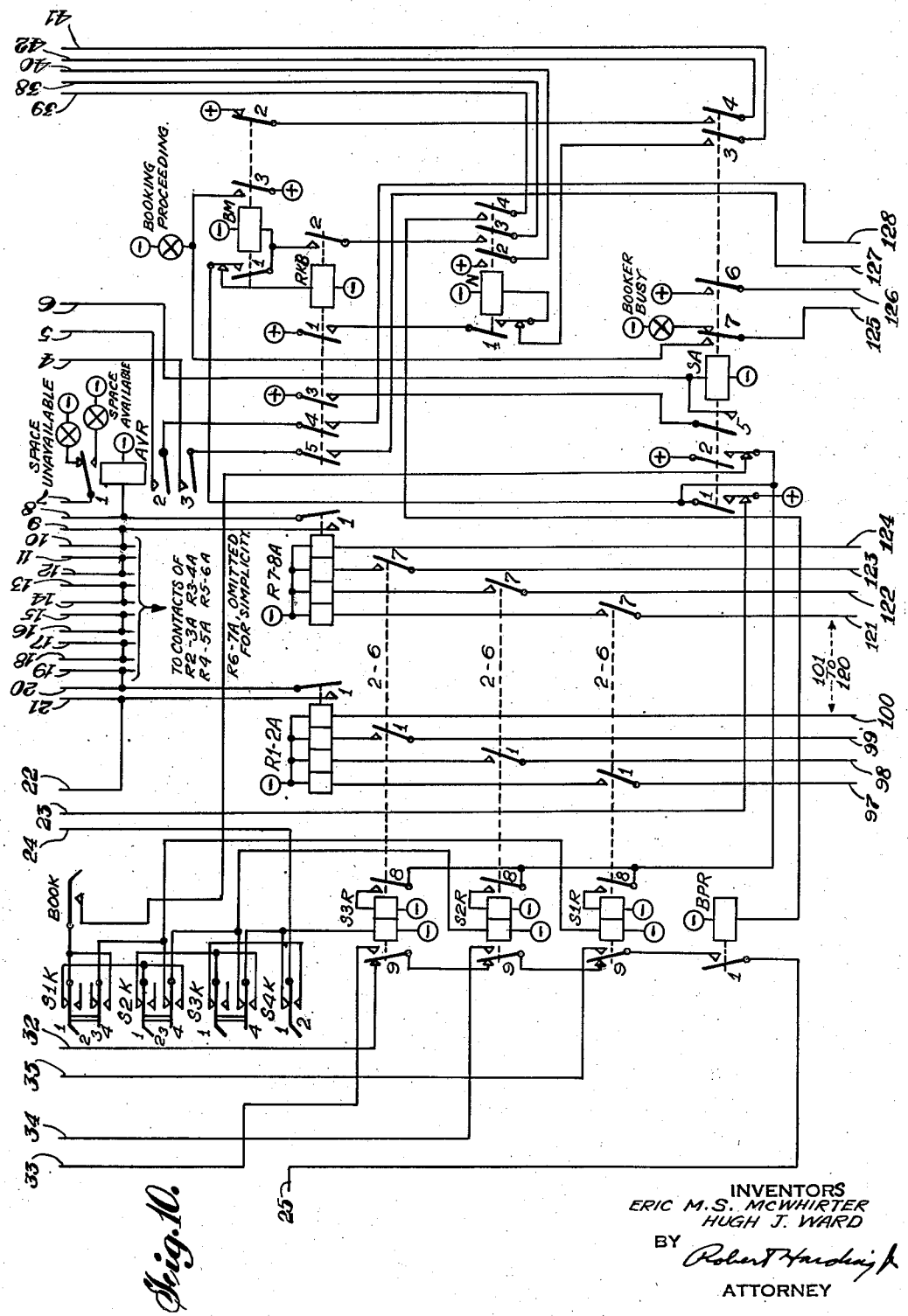


Fig. 10.

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RESERVATION SYSTEM

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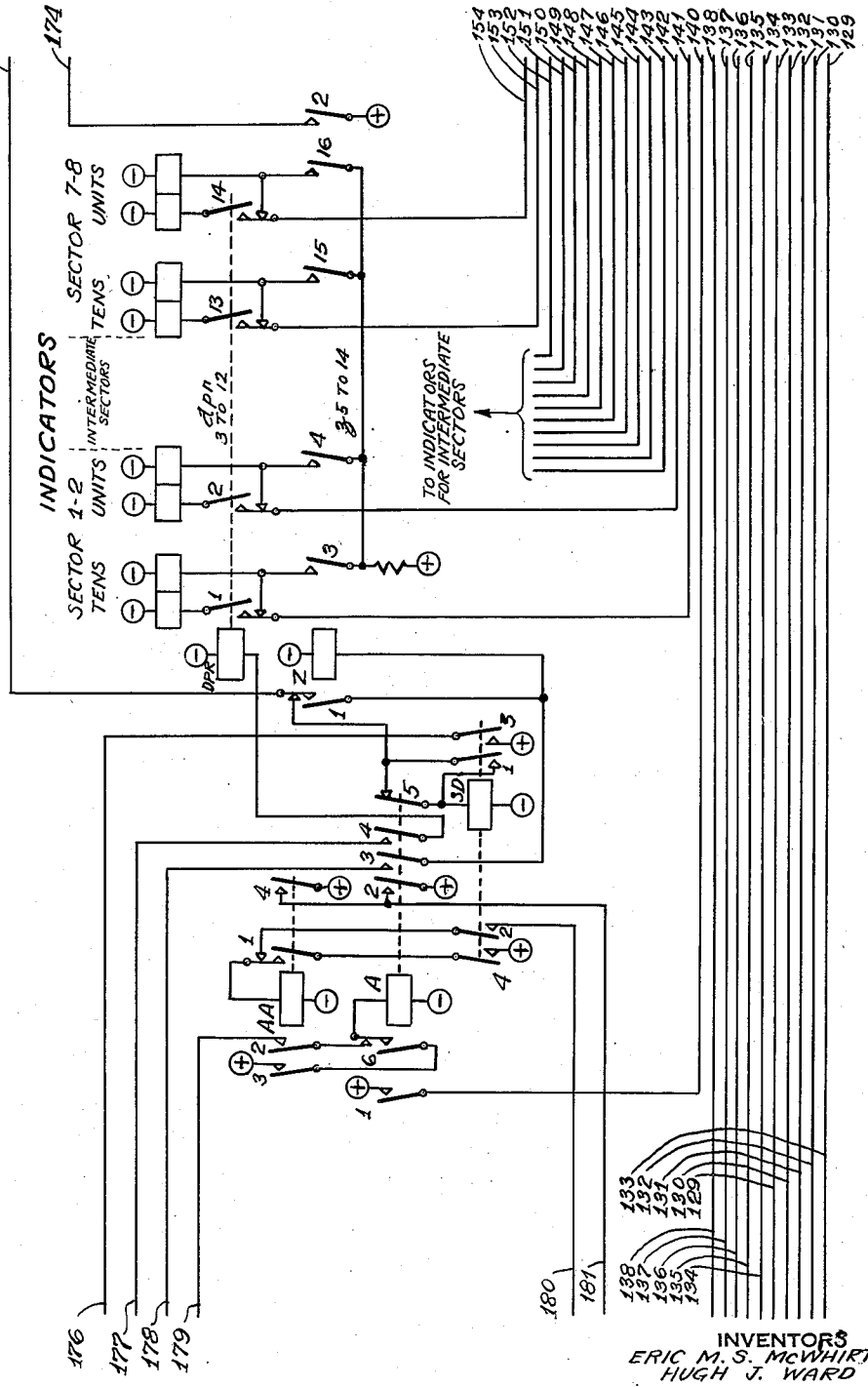


Fig. 11.

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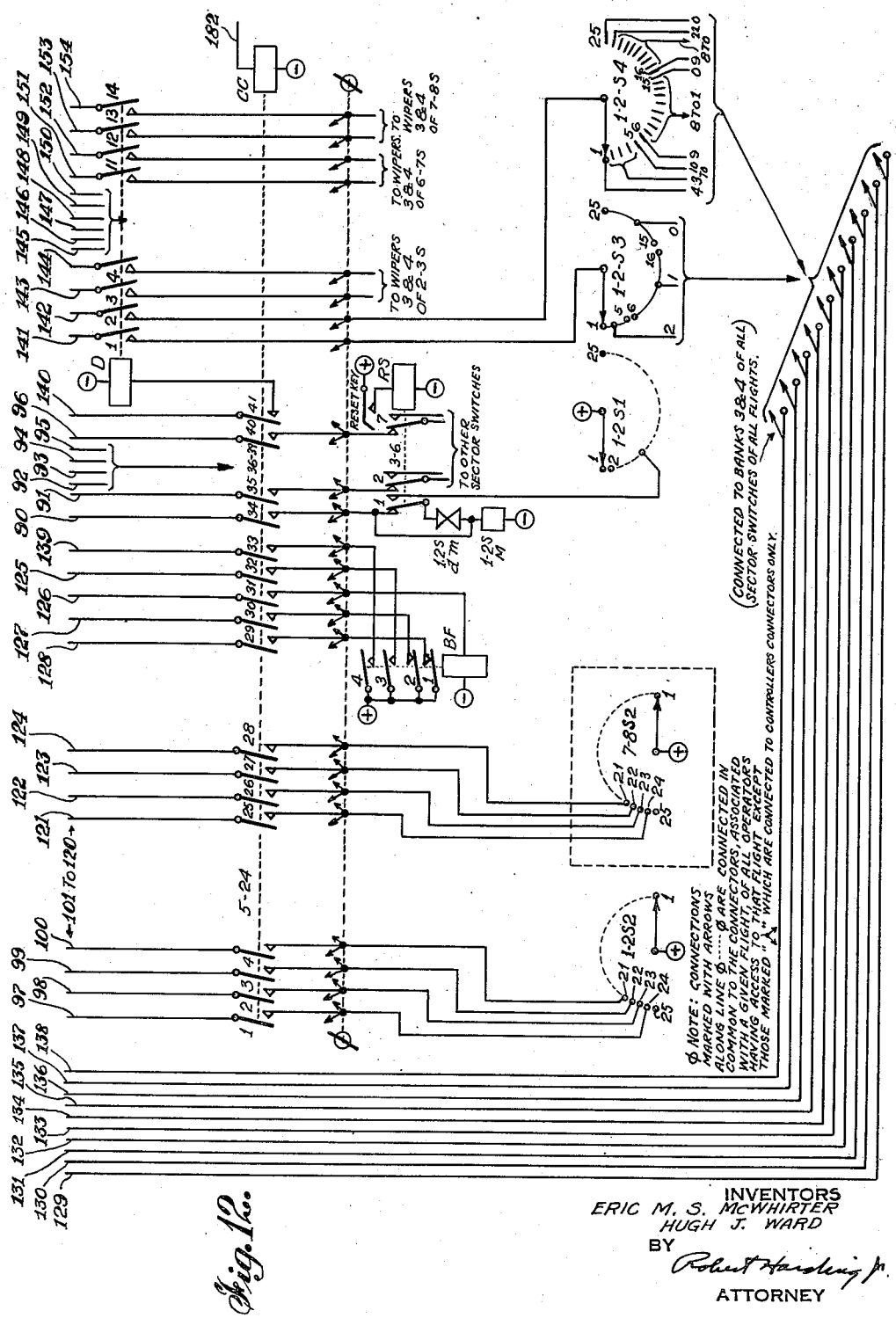


Fig. 12.

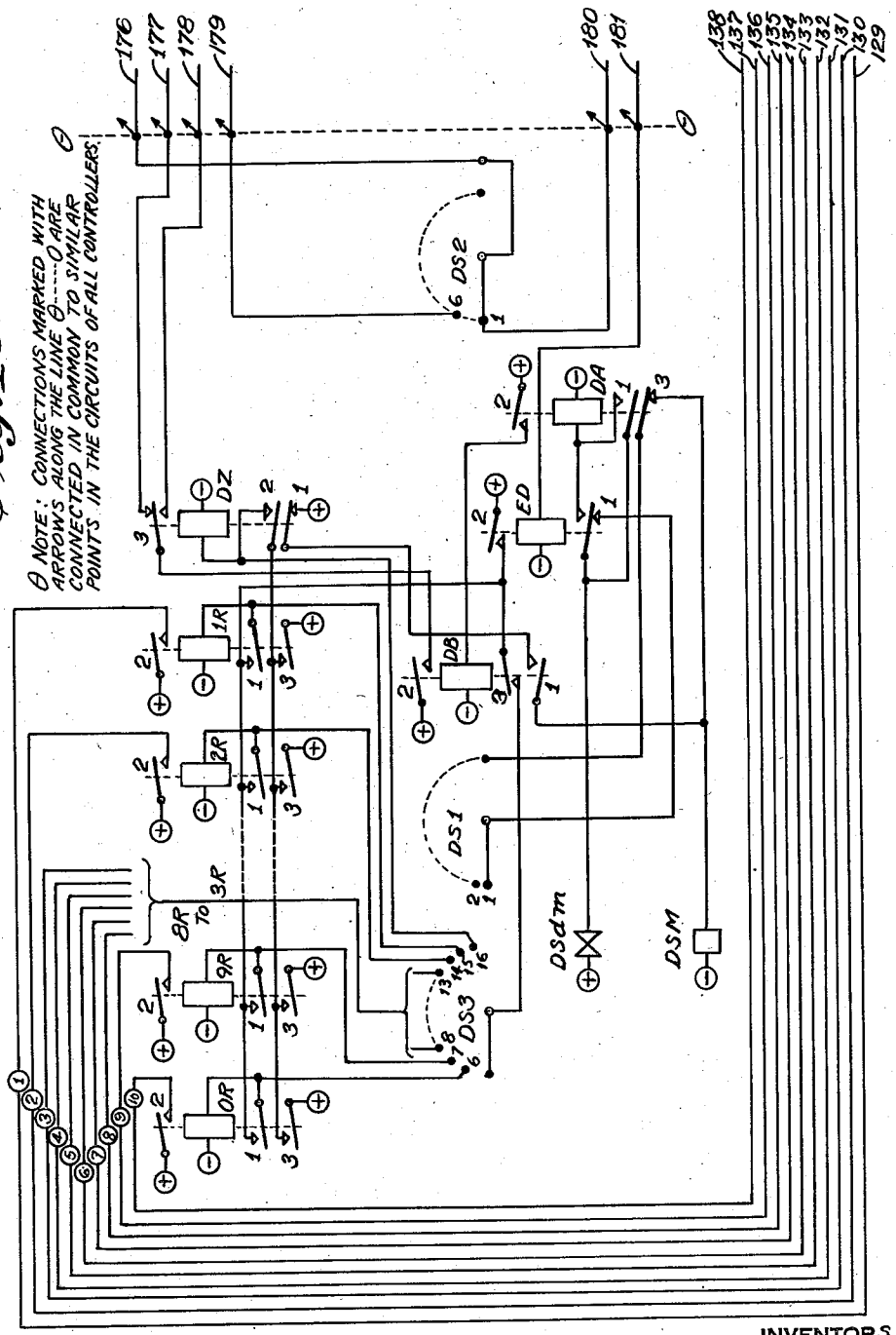
INVENTORS
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RESERVATION SYSTEM

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Fig. 13.



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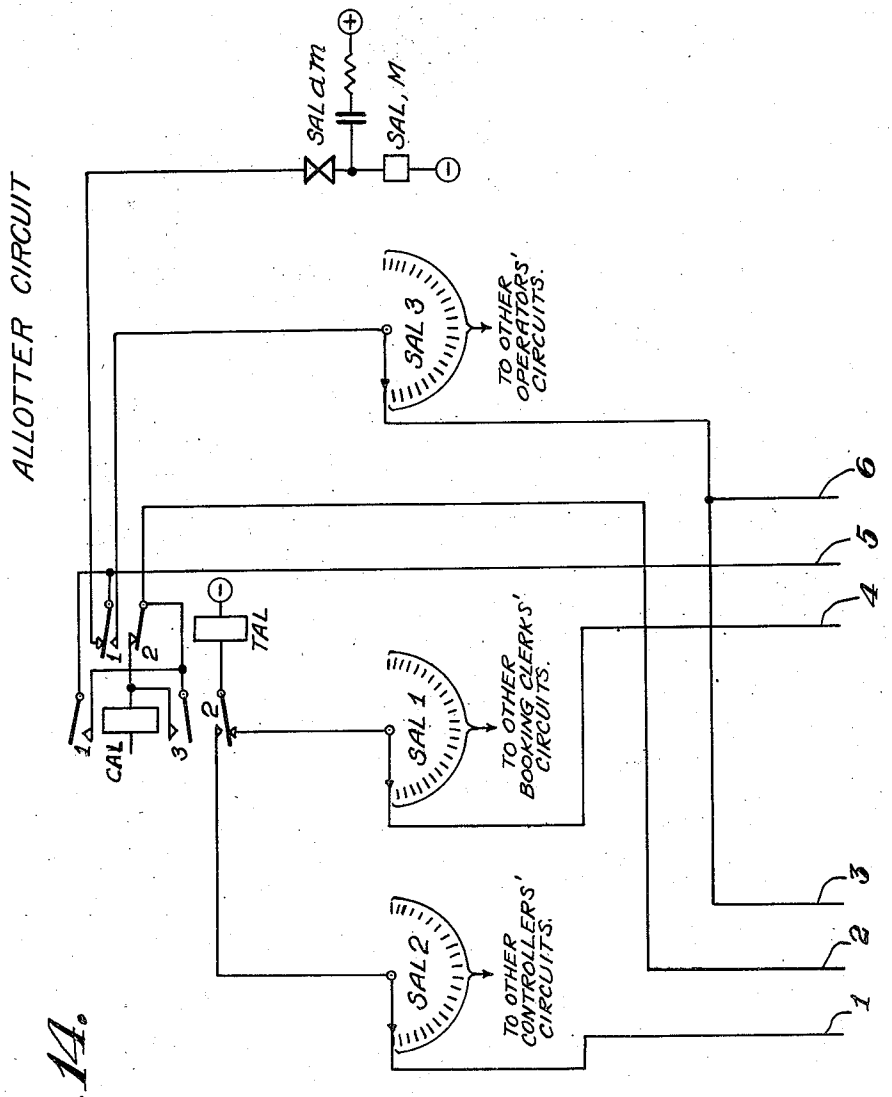


Fig. 14.

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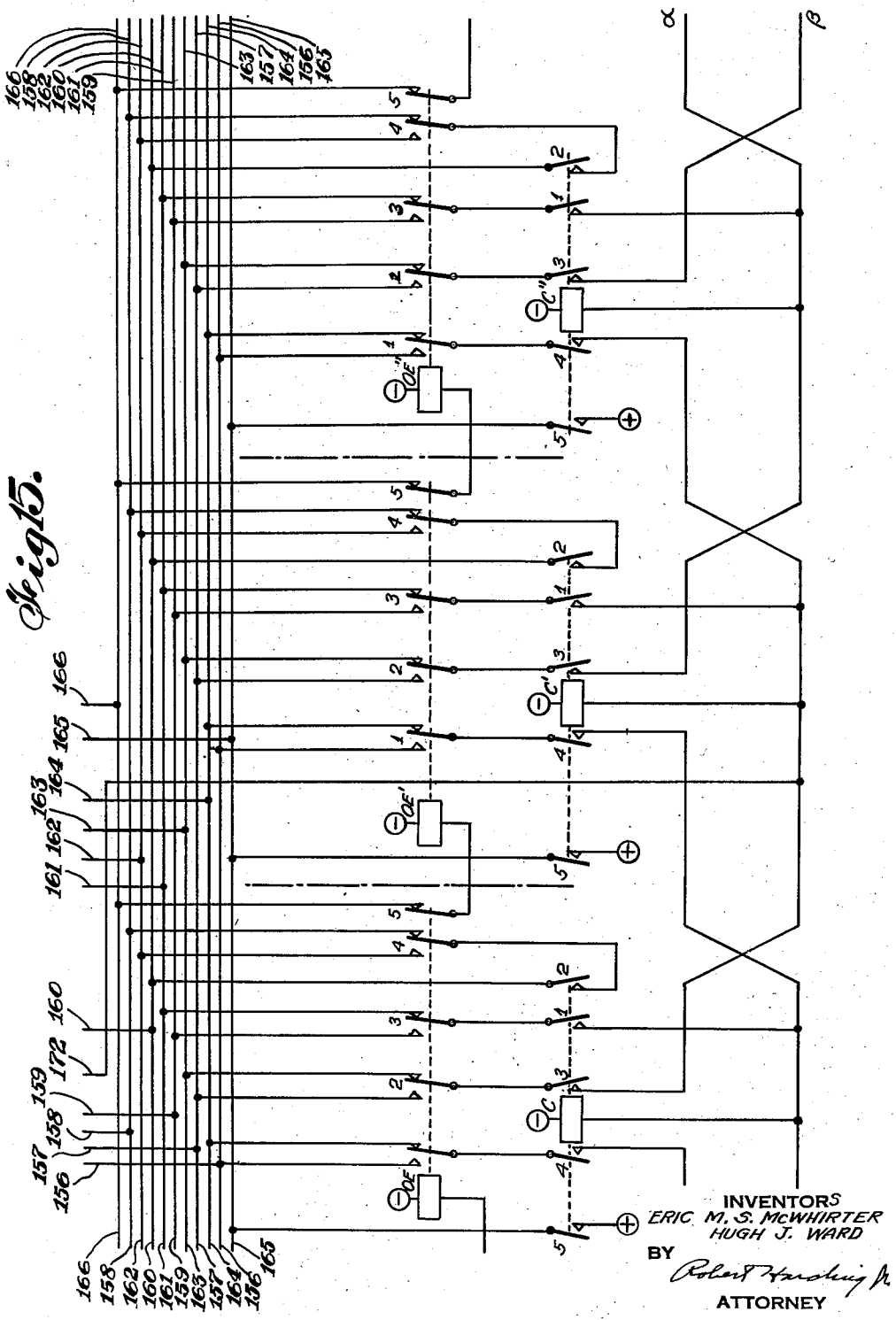


Fig. 15.

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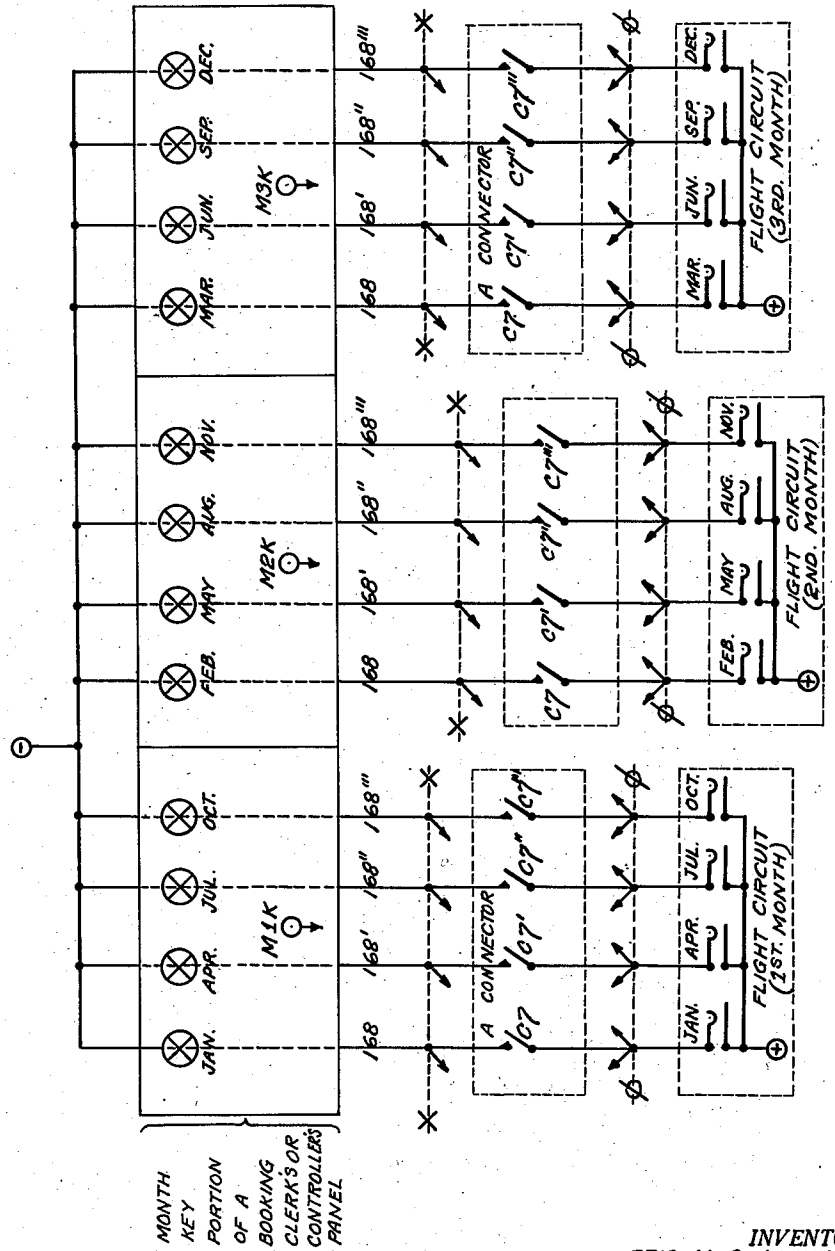


Fig. 16.

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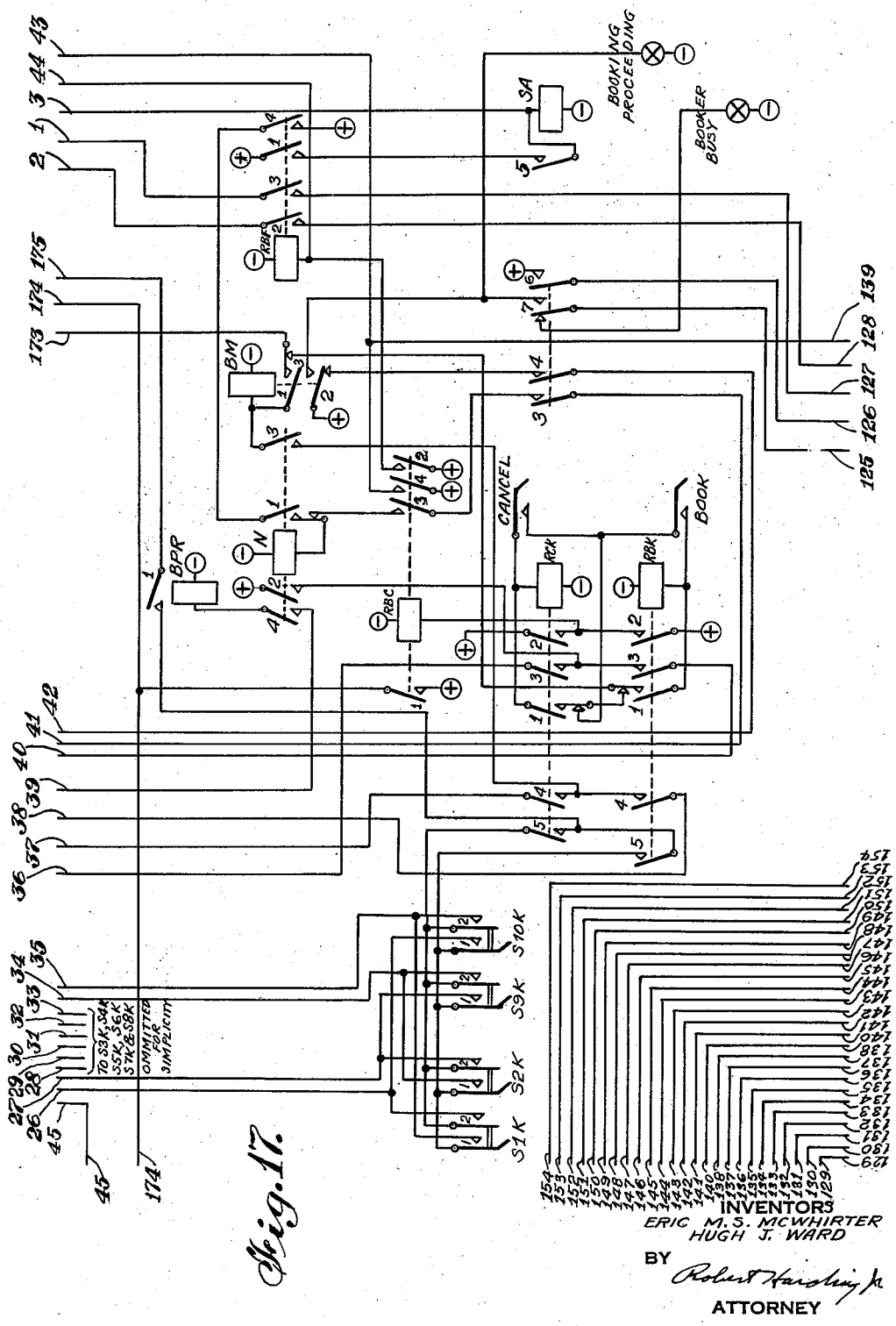


Fig. 17.

INVENTORS
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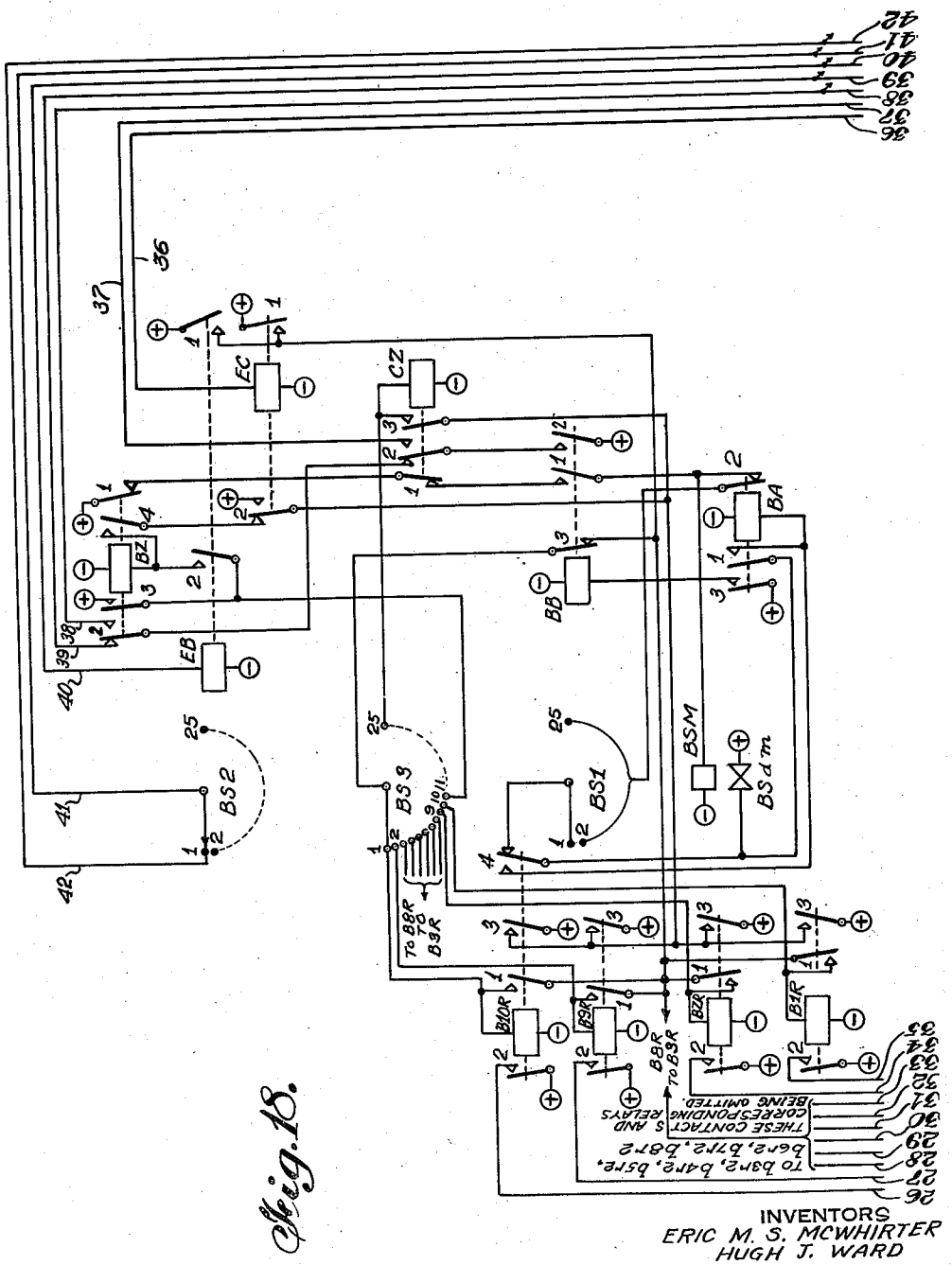


Fig. 18.

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Sept. 25, 1951 E. M. S. McWHIRTER ET AL 2,568,756

RESERVATION SYSTEM

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Fig. 19.

BOOKING CLERKS' CIRCUITS

FIG. 14.	FIG. 18.	
FIG. 21	FIG. 22.	FIG. 6.
FIG. 9.	FIG. 10.	FIG. 7.
FIG. 23.	FIG. 24.	FIG. 25.
	FIG. 12.	FIG. 8.

Fig. 19A.

"ADVANCE" & "REGRESS" FACILIT.

FIG. 6.
FIG. 7.
FIG. 25.
FIG. 15.

Fig. 20.

CONTROLLERS' CIRCUITS

		FIG. 18.	FIG. 14.	
		FIG. 26.	FIG. 27.	FIG. 6.
FIG. 13	FIG. 11	FIG. 17.	FIG. 9.	FIG. 7.
		FIG. 28	FIG. 29	FIG. 25.
			FIG. 12	FIG. 8.

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RESERVATION SYSTEM

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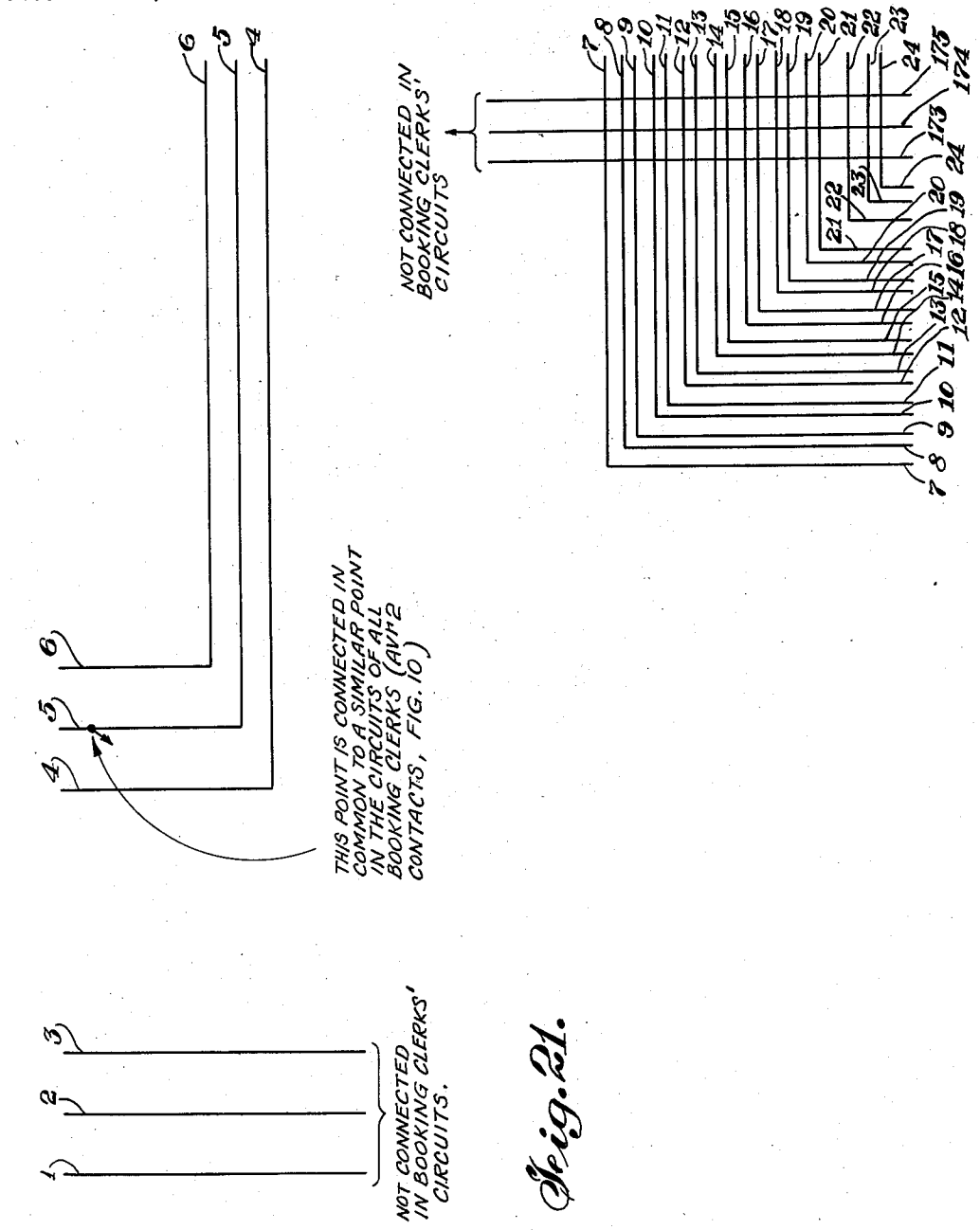


Fig. 21.

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RESERVATION SYSTEM

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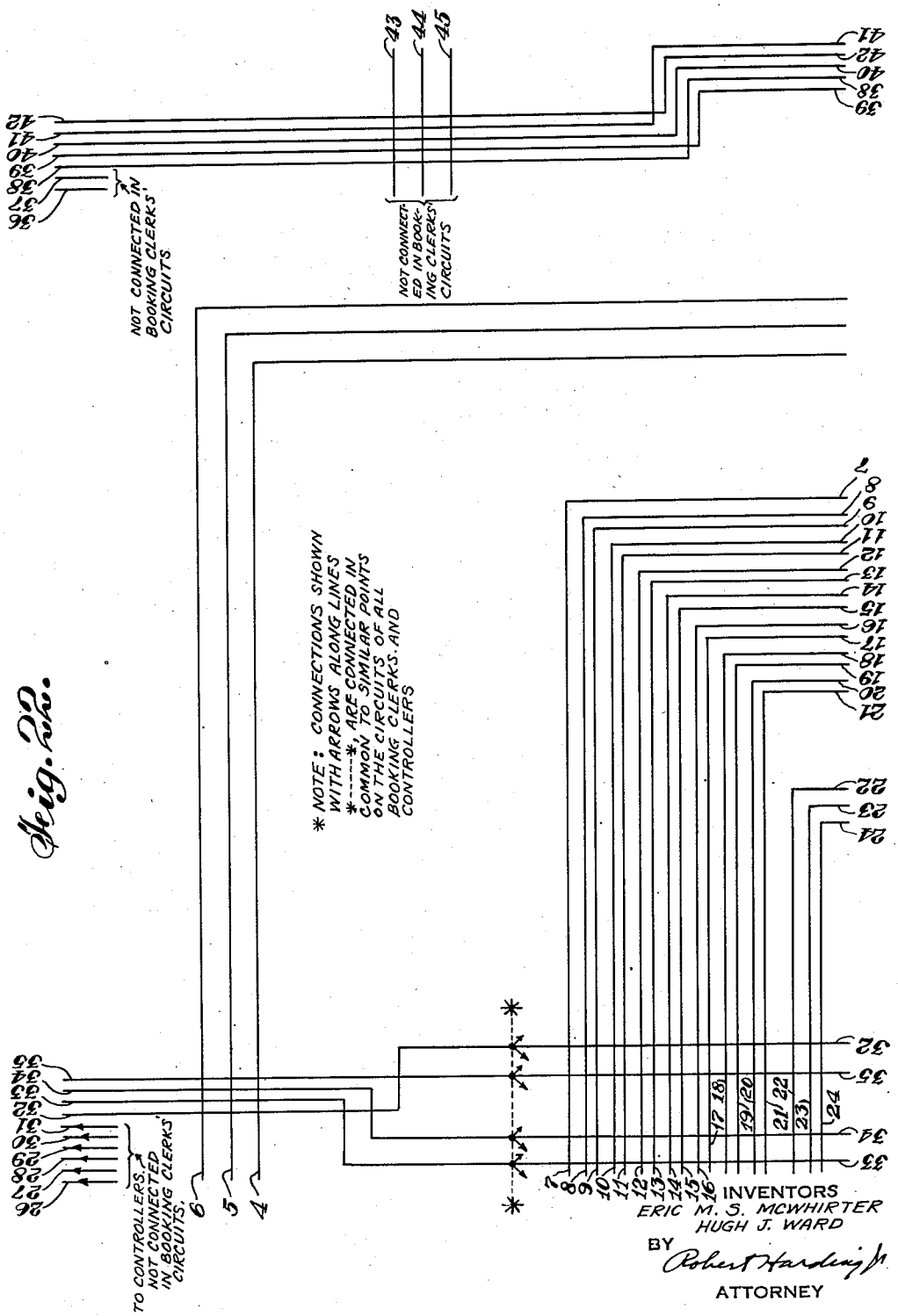


Fig. 22.

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RESERVATION SYSTEM

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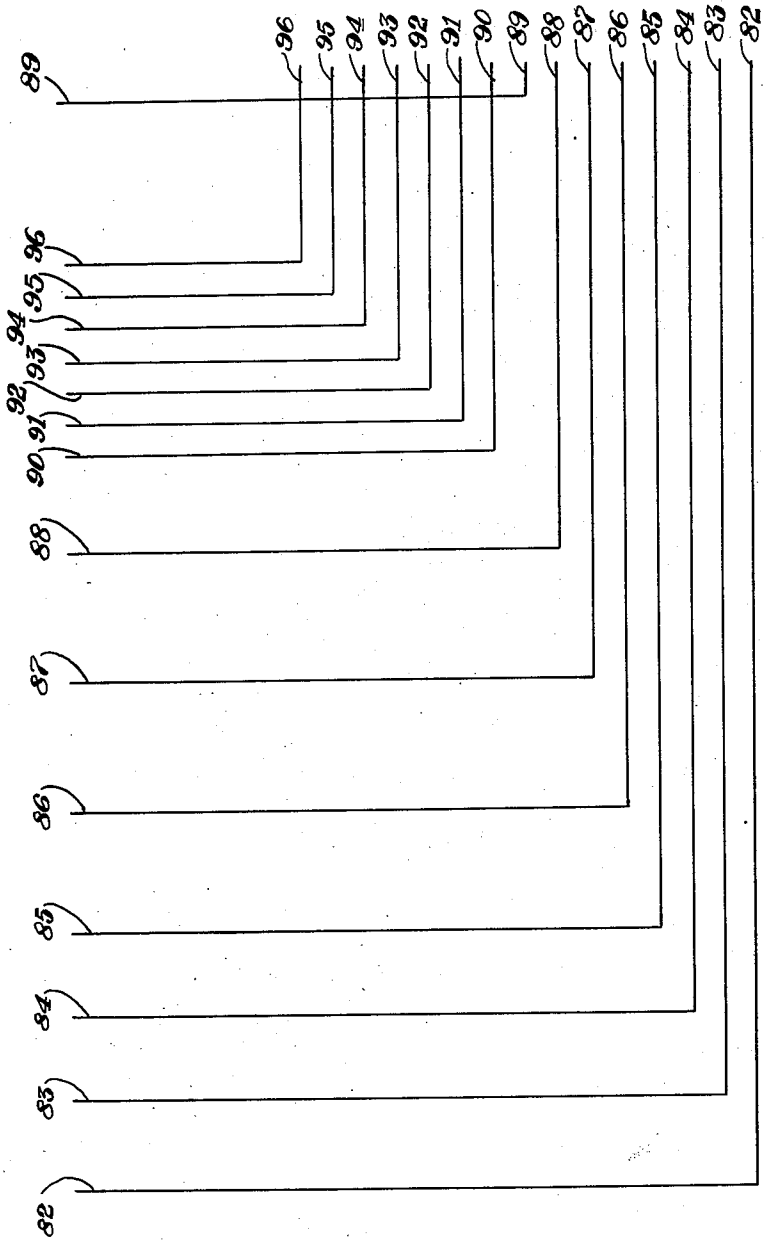


Fig. 22.

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RESERVATION SYSTEM

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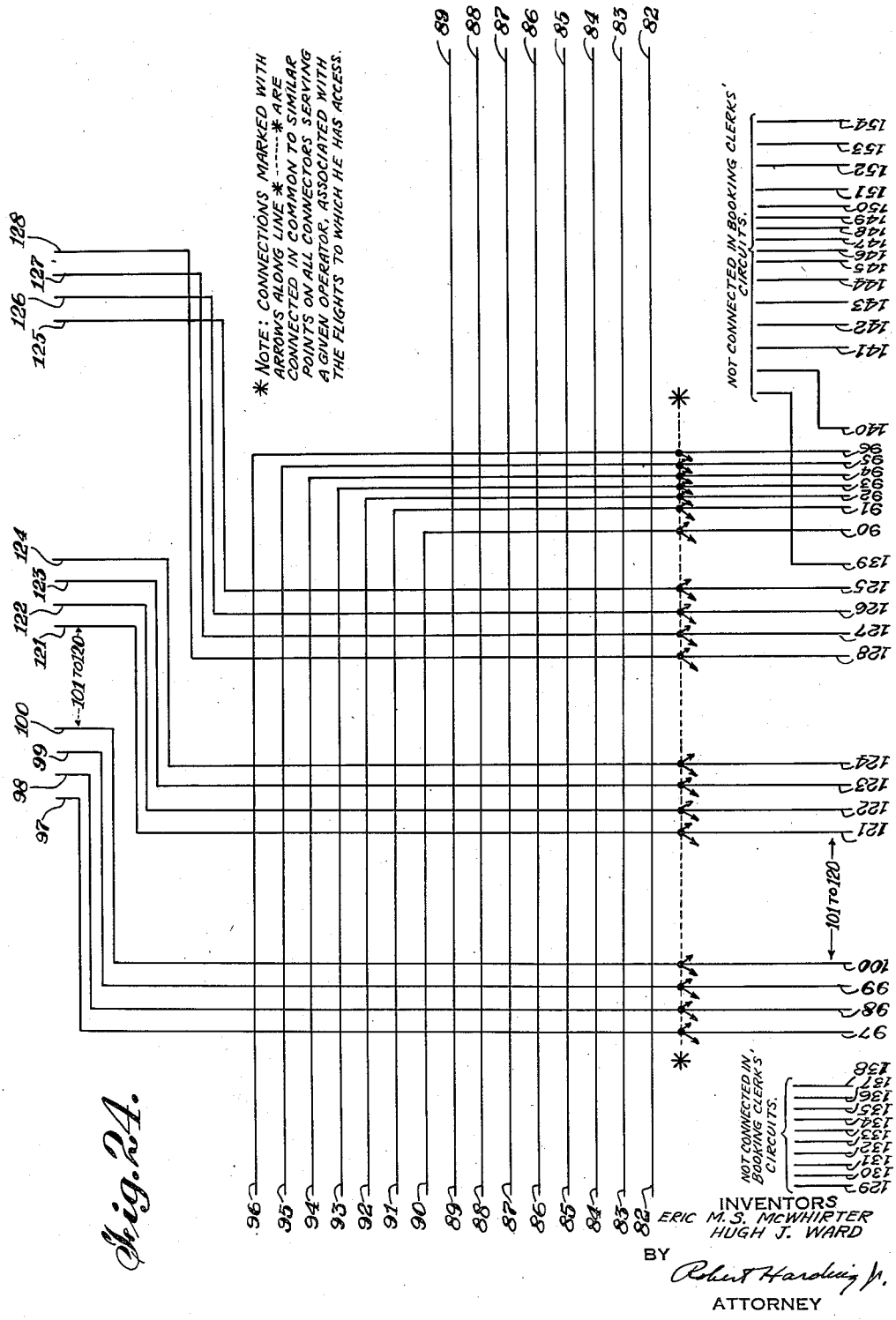


Fig. 24.

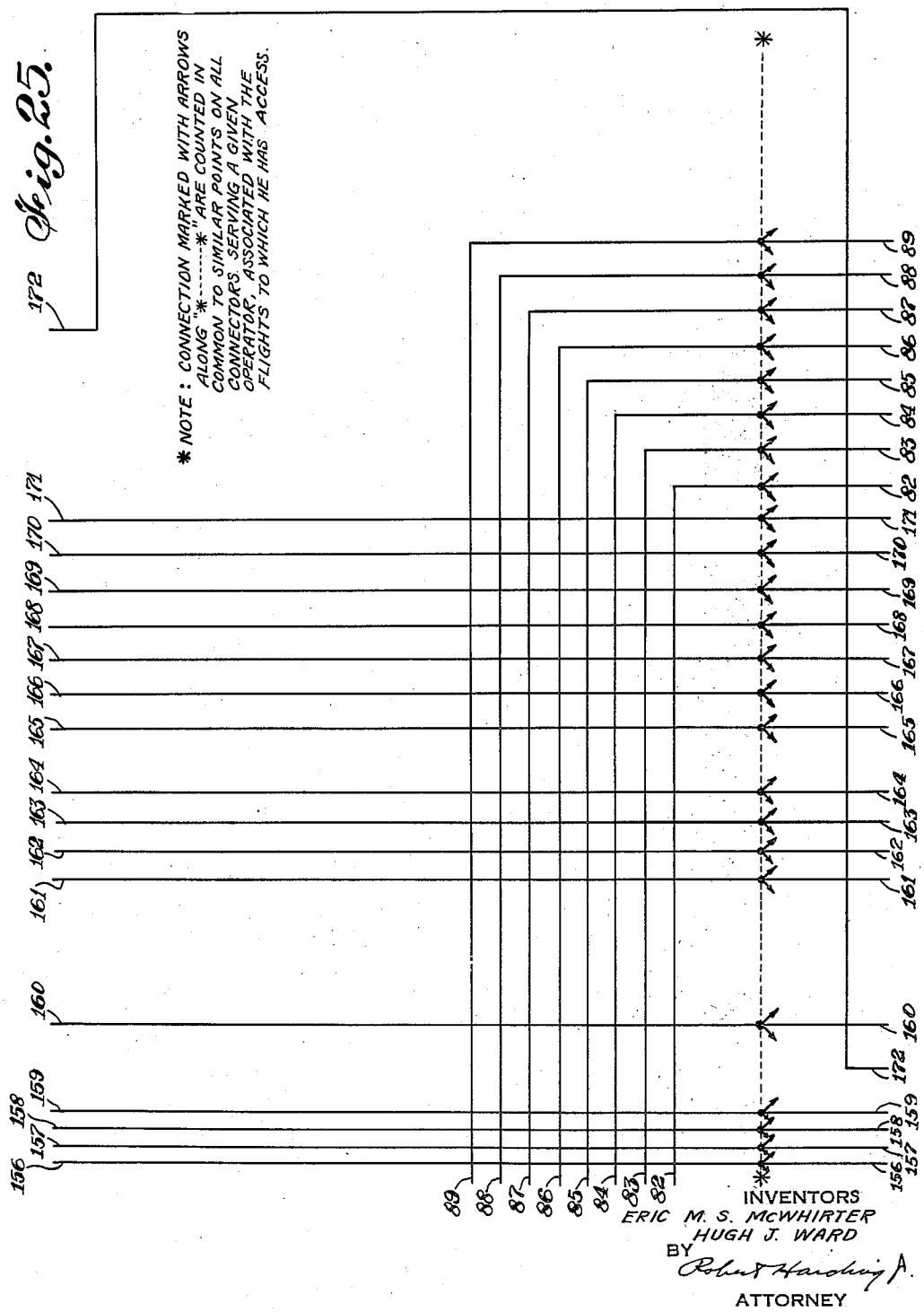
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RESERVATION SYSTEM

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RESERVATION SYSTEM

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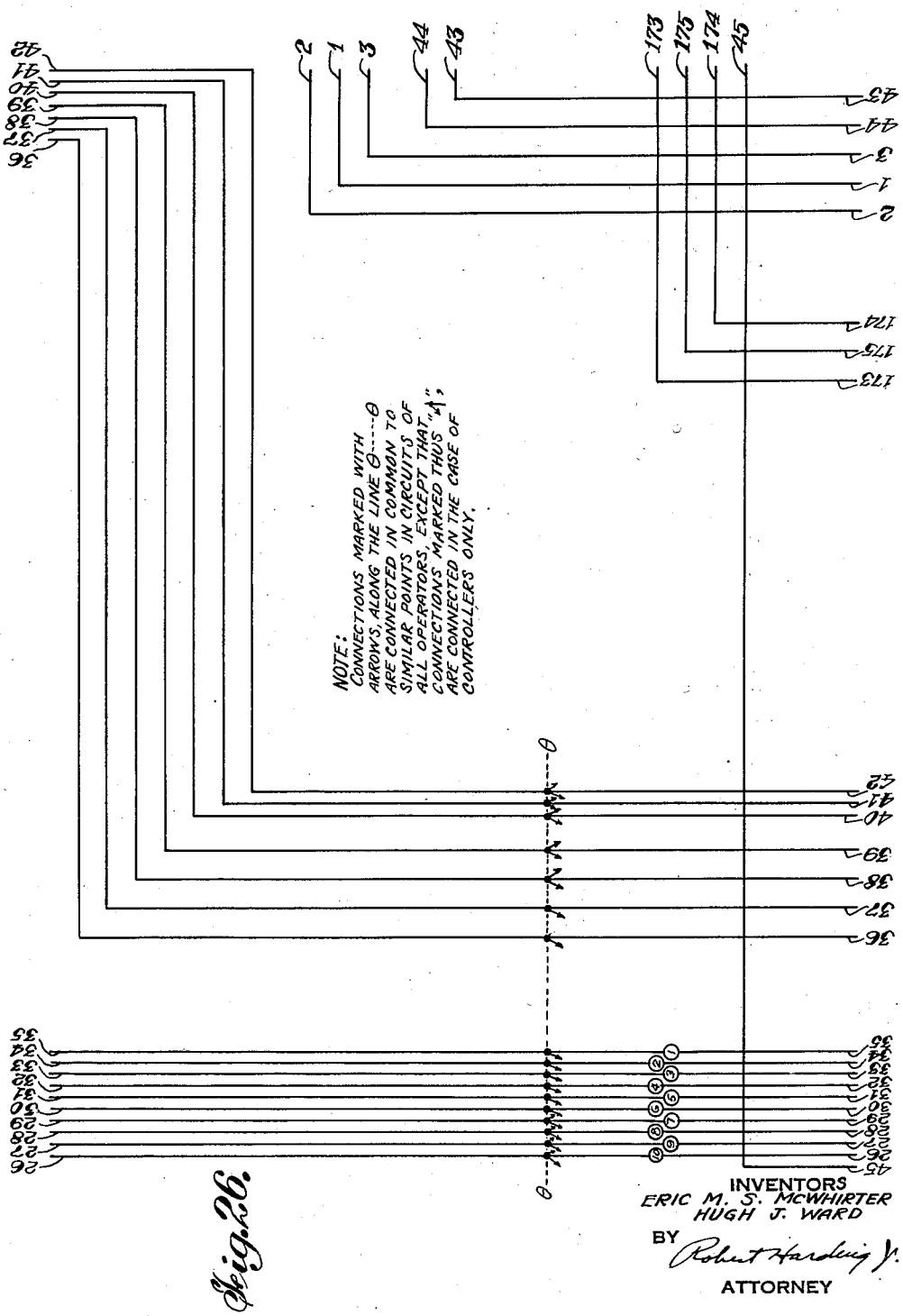


Fig. 26.

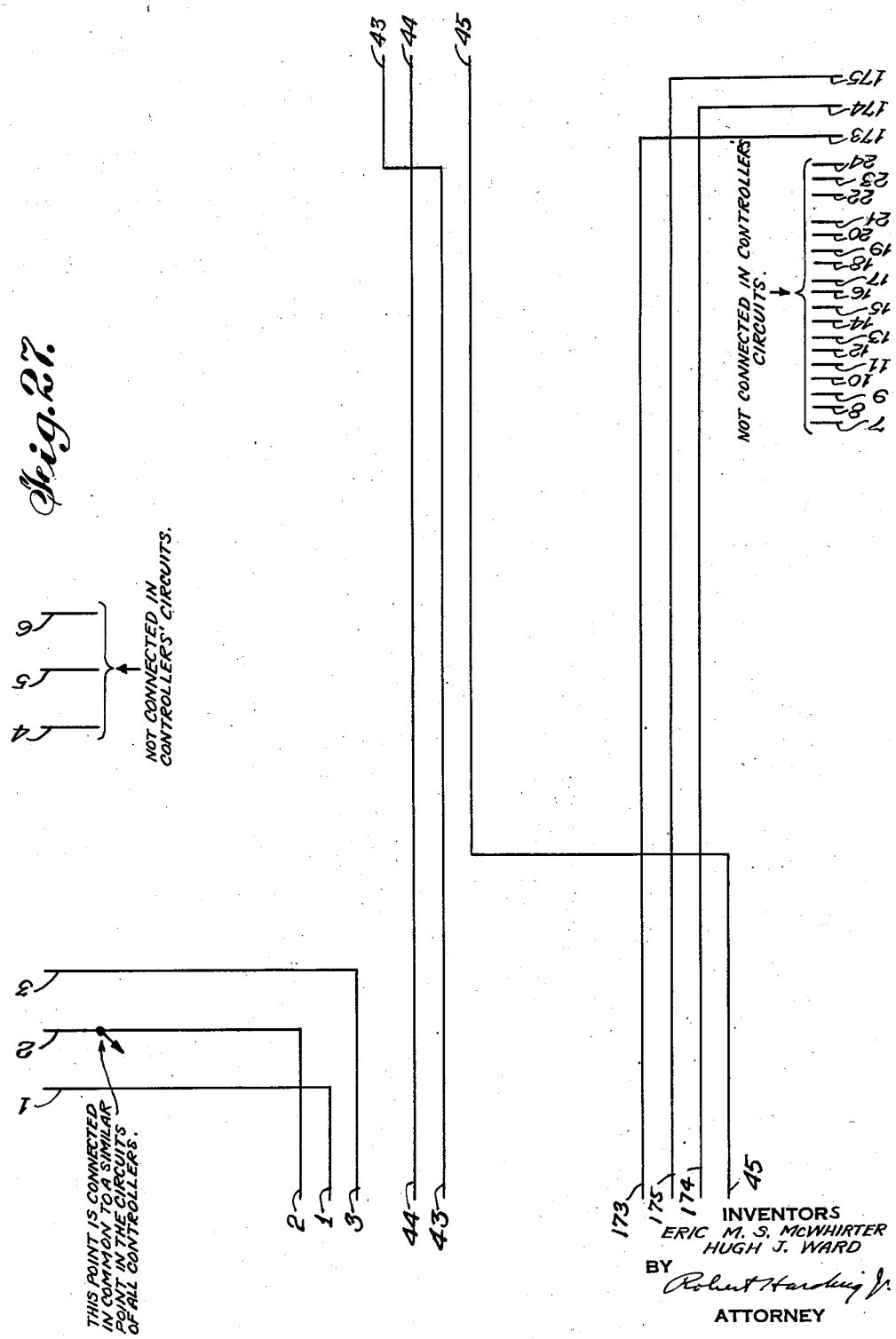
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RESERVATION SYSTEM

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Fig. 27.



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RESERVATION SYSTEM

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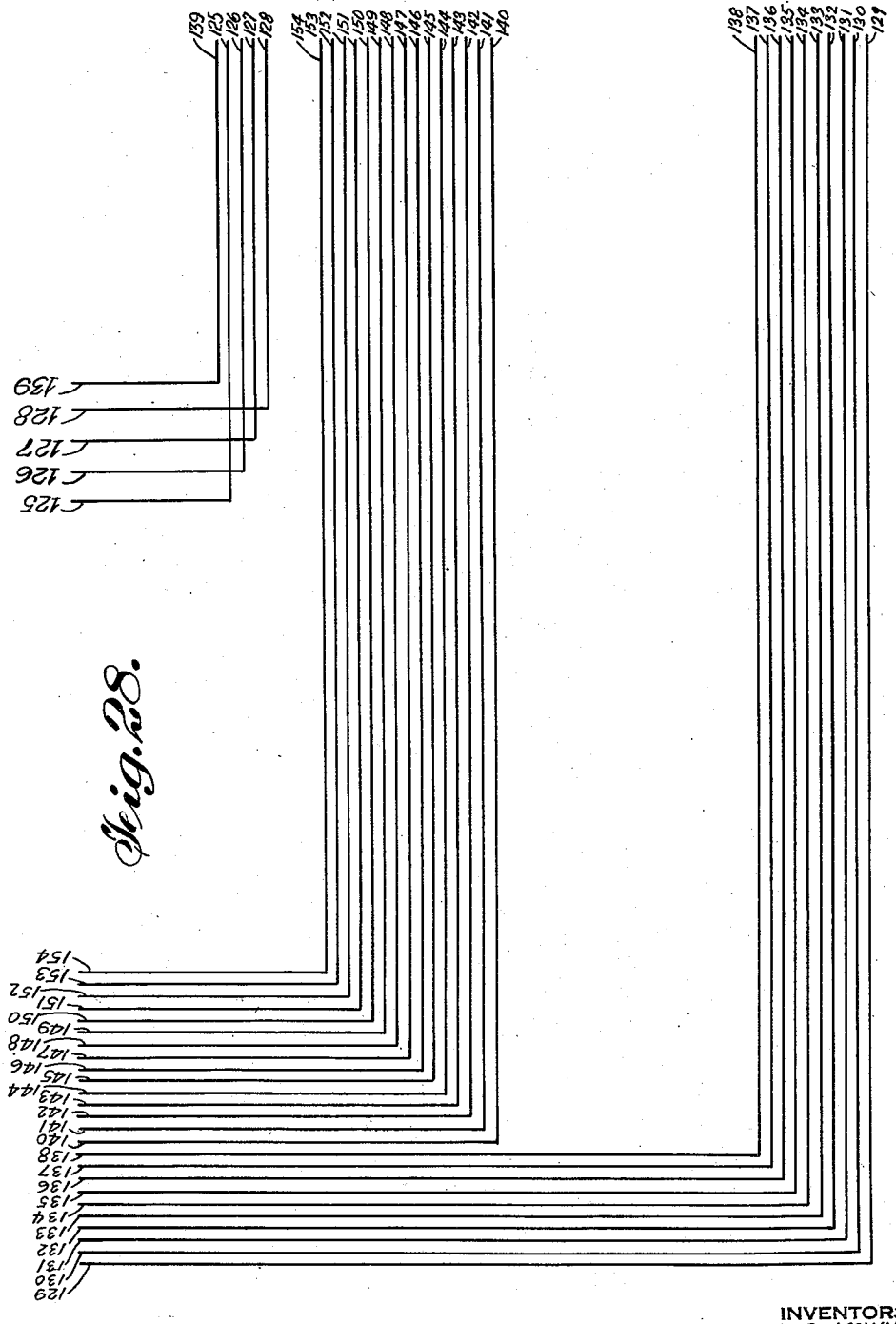


Fig. 28.

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RESERVATION SYSTEM

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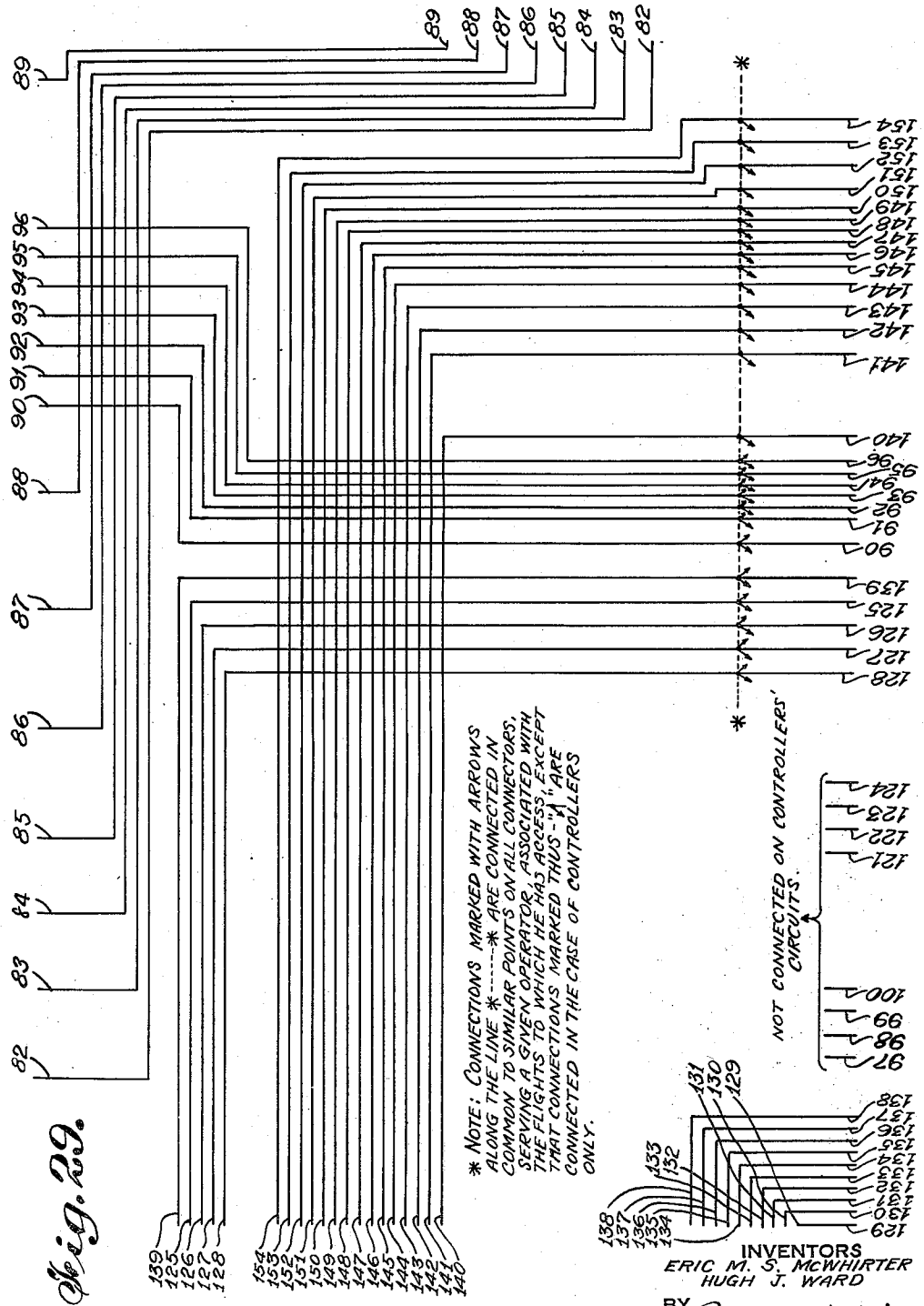


Fig. 29.

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Patented Sept. 25, 1951 2,568,756

UNITED STATES PATENT OFFICE

2,568,756

RESERVATION SYSTEM

Eric Malcolm Swift McWhirter and Hugh Jennings Ward, London, England, assignors to International Standard Electric Corporation, New York, N. Y.

Application November 9, 1946, Serial No. 709,010
In Great Britain September 5, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires September 5, 1965

18 Claims. (Cl. 177—353)

1

This invention relates to recording systems, and has for its object a system capable of a variety of applications.

The main feature of the invention is a recording system comprising a plurality of separate recording means, a plurality of enquiry positions, and means whereby any position can obtain information as to the setting of a plurality of recording means and can control the setting of a plurality of recording means.

Application to booking of accommodation—General requirements

The invention is particularly, though not exclusively, applicable to the automatic booking of accommodation in aeroplanes, vehicles, theatres or the like.

In such a form of the invention, information on the state of bookings can be obtained by the lighting of lamps or the setting of indicators upon a panel in front of an operator, on operation of keys, push buttons or the like, indicating the date, month, route performance or other identifying particulars material to the question the apparatus will be required to answer. Alternatively some display panels can be aranged to indicate positively, the space available, on visual numerical indicators, and others to indicate whether a certain amount of accommodation, is or is not available, by means, for instance of "available," "not available" lamps. Alternatively it can be arranged that the apparatus will hunt for the first trip or performance for which accommodation is available, particulars of such trip or performance being indicated by automatic indicators on the display panel. Registers are provided to record bookings of accommodation and the apparatus will permit accommodation to be booked by operation of further push buttons, keys or the like and will provide means whereby a supervisor or controller with a specially equipped panel, can bar certain journeys or showings or parts thereof from examination and booking by the ordinary booking clerks and can prevent bookings whilst he is either examining or booking on any individual aeroplane, vehicle, theatre etc., but without of necessity holding up bookings generally. Bookings will be recorded in the said registers.

Another feature of this form of the invention is that standard apparatus may be used for aeroplanes, vehicles, theatres etc. which have varying amounts of accommodation, the excess capacity of the equipment being neutralised by pseudo-bookings or other setting means so that indications of space available and bookings, will

2

subsequently correspond with the real accommodation available.

Embodiment for aircraft bookings—facilities provided

An embodiment has been developed for aircraft bookings based on the following general considerations and conditions of use:

Booking for air travel and transport is complicated by a number of considerations peculiar to it. Amongst them are—

(*a*) Weight and bulk restrictions.

(*b*) Specific limits to the number of passengers carried on one plane.

(*c*) The need to have instantaneous sight of accommodation available over a considerable period.

(*d*) The need to be able to make reservations of accommodation for the whole or part or parts only of an individual journey having several ports of call.

It is proposed that all enquiries from the public or from agents, shall be received at a central office equipped with apparatus according to this embodiment of the invention.

The staff of this central office will consist of a number of operators some of whom will be booking clerks and a lesser number of whom will be supervisors or controllers, to supervise the work of the booking clerks.

Booking clerks may be given access to all services handled at the office, or may be grouped in any convenient manner to sub-divide the work. For instance, a group of clerks may be assigned to a given number of routes, or to a certain time period, or to a combination of both.

One or more controllers may have the supervision of a group or groups of booking clerks.

It will usually be necessary to make a controller responsible for introducing a flight on to the apparatus, the word flight being used herein to mean a particular journey by one plane on a given route and at a given starting time and date, and for making it available at a suitable time, to the booking clerks.

In discharging this function, a controller will first select an idle set of registers and set them to correspond with the size of the aircraft concerned, and with the number of stages of the journey concerned since it is intended, in the embodiments described, that standard sets of standard switches shall be used for the registers. This will be done by making pseudo-bookings to neutralise the extra capacity of the switches, in the case of aircraft having less accommoda-

tion or journeys having fewer stages than the maximum capacity of the registers. In special cases, the installation will be permanently wired to suit the individual services in connection with which it is to be used but this limits the flexibility of an installation and is not envisaged in the embodiment described.

There will then usually be some bulk bookings to be made for mail and the like, and possibly also the reservation of space to be held in reserve for unforeseen commitments.

Whilst this is being done the section of the apparatus which is being thus adjusted will be switched in such a way that booking clerks do not have acsess to it and it may be arranged that the switches by which this is effected are placed near to the controller or are grouped together with the registers in a central position. Another function of a controller will be to plug up certain "barring" circuits associated with the registers, so that certain intermediate sectors of a journey may not be booked separately.

This facility is required to prevent, for instance bookings from London-to-Paris on planes going to India, which would effectively defeat a like number of passengers wishing to make the complete journey, or to prevent bookings of journeys between airports wholly within a territory claiming a monopoly of internal air travel, on a longer journey including landings at such airports.

The flight may now be made available to the booking clerks who may examine space available and make bookings upon the flights assigned to them.

The number of seats which can be booked at one time, will usually need to be restricted since large bookings tend rapidly to reduce general availability. In the embodiment described, this number is fixed at four, but any appropriate number can be catered for in the making of the installation. Larger bookings than this will be referred to a controller who is enabled in the embodiment described, to book up to ten seats in one operation but may of course overcome this limitation by booking in two operations.

A controller can also cancel a booking.

Before departure of a flight, a controller will probably take steps to fill any vacant seats, for instance, with customers whose bookings have been refused or postponed. The period for which bookings can be undertaken in advance must be limited to a number compatible with an economic cost for the installation since registers have to be provided for every flight within such period. In the embodiment described, the period is three months, but it can be made greater or less by suitable modification to the installation.

As soon as a flight has departed on its journey, it is envisaged that bookings, even for later stages of a long journey, should be forbidden to booking clerks and that the controller concerned will operate the switch he originally operated whilst setting up the registers to the flight, to deny to booking clerks access thereto. According to the organisation used, the controller may then have certain powers to make bookings for the later stages of the journey or the whole of further bookings may be relegated to branch offices along the route.

Once all necessary records have been compiled, the information contained in the registers is no longer required and this part of the equipment can be made available for another flight. In this manner, a booking period constantly so far in advance can be maintained, sets of registers becoming available for flights beyond those at the time open for booking, as soon as they are freed by the departure of a flight.

In the apparatus to be described, booking clerks will sit at a number of desks or "positions" with lamps, keys, indicators, buttons, etc. and controllers sit at desks or "positions" closely resembling the booking clerks' positions but having somewhat wider facilities.

The panel or position of a booking clerk has various keys representing routes, months, days of the month, and terminal and intermediate airports along a route. Also the panel has lamps indicating the position to which the above keys have been set and others named "Journey Barred," "Flight Unavailable," "Space Unavailable," "Space Available," "Booker Busy," "Booking Proceeding," and "Flight Lamps," the functions of which are evident from their names.

On receipt of an enquiry, a booking clerk will operate keys for the route and date required and, unless the "Flight Unavailable" lamp lights on his panel (which would indicate that the controller had withheld a certain aircraft altogether from access by booking clerks), the lamps indicating the route and date will light and also the flight lamp corresponding to the "Preferred" flight for the date in question. He will then operate keys corresponding to the end airports of the journey required and will receive, either the "Journey Barred" signal (indicating that bookings cannot be made for that particular journey, for reasons of policy; a setting applied by a controller effects this), or the "Space Unavailable" signal (indicating that at least one sector of the journey is entirely booked up), or the "Space Available" signal (indicating that there is at least one seat available for the whole journey).

In the event of getting a "Space Available" signal, the operator then presses his "space" key corresponding to the number of seats required by the enquirer and if there is not this accommodation available, the "Space Unavailable" lamp replaces the "Space Available" lamp.

The operator can then try the availability on other flights on the same date. The choice of the "Preferred" flight of the day will depend upon a number of considerations of policy which cannot be laid down in advance. It may be desired to direct all bookings in the first instance, to the most convenient flight of the day, or in certain circumstances to a less convenient flight to avoid premature booking up of the most convenient flight. The adjustment for this choice is shown as a semi-permanent connection in the accompanying drawings but it may be made to be more readily alterable. On operating an "Advance" key the apparatus indicates the state of the next later flight on the day and operation of a "Regress" key, the next earlier flight. On release of either key, the appropriate flight lamp lights, a row of these flight lamps on the panels of controllers and booking clerks indicating the flights of the day in chronological order and enough of them being provided to cope with the largest number of flights on a route in one day, to which the equipment relates. The flight lamps indicate the progress of the search and eventually the "Space Available" lamp lights when a flight having accommodation is found.

A controller proceeds in much the same manner up to a point, but does not use his space keys to enquire whether space is available, since his indicators automatically set themselves to the space remaining unbooked on all sectors of

a flight. Similarly, in searching, his indicators cancel on pressing the advance or regress key and re-set themselves to the successive flights searched, on release of the key.

When the space is discovered and it is required to book the seats, a "book" key is depressed and either the "Booker Busy" lamp lights, in which case the booking may be held up for a few seconds, or, if the last space is in the process of being booked, the "Space Unavailable" lamp may re-light, indicating that another operator has secured the accommodation first. If and when the "Booking Proceeding" lamp lights, the registers of accommodation booked, for the sectors in question of the flight in question, will be advanced by the number of places booked.

A controller and booking clerk both proceed in the same way when booking seats except that when a controller is "examining" a flight, no-one else can book on it and when he commences to book he takes precedence over others: A number of booking clerks and controllers can, however, examine a flight simultaneously.

A controller will usually set the equipment to correspond with the conditions prevailing, before making a flight available to the booking clerks, as already outlined, making the remaining space, showing to an operator examining the flight before booking, to correspond with the capacity of the aircraft and the number of stages in the journey, by pseudo-bookings which will probably be done at one time for a number of flights on a given route.

Block bookings and reserve accommodation will next be recorded and during this time the flight will be withheld from booking clerks by the operation of a "busy-free" key, associated with each flight, in the "Busy" position. When this is complete the flight will be made available to the booking clerks, by throwing the "Busy-Free" key to the "Free" position. With this key in the "Busy" position, the flight concerned will be signalled "Flight Unavailable" to the booking clerks.

A controller in addition to booking, can cancel bookings by use of a cancel key, in combination with the "Space" key of the number corresponding to the number of seats to be cancelled. A booking clerk cannot do this however.

General description of embodiment and explanation of figures

The description of the preferred embodiment will now be continued in relation to the accompanying drawings:

Fig. 1 shows a general schematic of the whole installation designed to illustrate the relative numbers of the various component parts thereof, from which it will be seen that a number of booking clerks' positions, twenty being shown for illustration, are grouped together into a suite. In practice there may well be several suites. These booking clerks have access to a number of connecting circuits (or "Connectors" as they are herein called) each clerk having one connector, peculiar to himself, for each flight to which he has access.

The appropriate connector is selected by a combination of key, relay and switch operations which are condensed for simplicity into the form of a switch, in the figure, those of clerks 1, 6, 14 and 19 being enlarged as specimens, all in fact being identical.

The individual connectors each represented by a short vertical line along the top of the con-

nector circuit rectangle and a corresponding vertical line along the lower edge, are shown grouped in batches of different numbers, each batch being associated with the flights on some route on a particular day, a clerk having a direct outlet to only one of such flights in the group (the "preferred" flight explained above).

Only specimen connections from clerks to connectors are shown. The outgoing sides of the connectors are similarly shown with connections to corresponding specimen flight circuits and two of the clerks are shown as having access to one set of specimen flight circuits whilst two other clerks are shown as having access to another set of specimen flight circuits.

In fact several clerks will have access to any particular batch of flight circuits.

The flight circuits themselves are shown grouped together in the rectangle so named, each is represented by one of the short vertical lines emerging from the top of the said rectangle, and each of them consists of the switches, relays etc. (not shown) comprising the registers by which booking information is recorded and examined, details of which are described later and shown in other figures.

The controllers' positions, three of which are shown, two in some detail, have similar access to connectors associated with flights for which the controllers are respectively responsible. The figure shows specimen batches of flights and the particular controllers whose circuits are illustrated are further shown as having access to the same flights as the two groups of clerks, indicating that they will supervise the work of those clerks. In fact, a controller may have connectors associated with one set of flights to which a group of operators is assigned, or one controller might have access to the flights assigned to two or more groups of clerks.

The vertical lines at the top of the rectangle representing the suite of clerk's positions, each represent the outlet of one clerk to the allotter, on the left, and to the booker on the right.

In the case of the controllers, corresponding lines show the outlets to allotter, booker and controllers common indicator setting circuit respectively.

There is only one allotter, booker and indicator setting circuit respectively, to serve the whole installation.

Fig. 2 is a more detailed schematic diagram of the circuits operated by a booking clerk in which operations, in many cases carried out by a number of relays and keys, are shown for simplicity as if they were effected by one relay or key, sometimes named by the designation of the most important of them.

Fig. 3 is a similar schematic to Fig. 2 showing the circuits operated by a controller.

Fig. 4 shows diagrammatically, the front of a booking clerk's panel or position.

Fig. 5 shows diagrammatically, the front of a controller's panel or position.

Fig. 6 shows the circuits of the route keys, month keys, and day of the month keys and their associated relays of a controller's or a booking clerk's position. The numbers on the connections leading from the contacts of relays DT0R, DT1R, DT2R and DT3R, in the bottom right hand corner of this figure, indicate that such connections lead, to connections along the lower margin of Fig. 6. These connections are continued on Fig. 7 which should be placed below Fig. 6 and the two treated as one figure.

Fig. 7 illustrates a route switch circuit and ancillary circuits, of a booking clerk's or controller's position. The connections from Fig. 6 are connected to individual contacts of bank 2 of the route switch, corresponding to the numbers on the DT0R, DT1R, DT2R and DT3R contacts on Fig. 6, from which these connections proceed. Each operator has a separate route switch circuit for each route with which he is concerned and these numbered connections are "multipled" to the second bank contacts of all the route switches in an operator's position.

Fig. 7 also shows the route, month and date lamps of an operator's position.

Fig. 8 shows some of the circuits whereby a booking clerk or controller is connected to a flight circuit, the upper part of Fig. 8 forms part of a connector circuit (or "Connector," as it is hereinafter called), of which each operator has one for every flight to which he has access. The remainder of the connector circuit is shown on Fig. 12.

Fig. 8 also includes the "Busy-Free" key and "Barring Jacks" which form part of the circuit of a flight and are common to the whole equipment in the sense that there is only one such circuit for any given flight, in the whole equipment, all operators responsible for that flight having access to it.

Fig. 9 shows the circuit of an operator's airport, or sector keys and associated relays the "Journey Barred" lamp and the "Flight Unavailable" lamp (whether booking clerk or controller, the term "Operator" being used herein to indicate either).

Fig. 10 shows the circuits of a booking clerk's space keys and associated relays, the "Space Unavailable," and "Space Available" lamps and their associated circuits, the book key and some of the associated circuits.

Fig. 11 shows the space available indicator circuits of a controller's position.

Fig. 12 should be placed on the left of Fig. 8 and the two read together as one figure. The upper half of Fig. 12 shows the remainder of a connector. Taking the top halves of Figs. 8 and 12 together, it will thus be seen that a connector consists of four relays, C, CC, D and OE. C has 19 sets of contacts, CC has 41 sets of contacts, D has 14 sets of contacts and OE five sets of contacts. It may be desirable to use two or more relays in the place of each of these relays to avoid the use of special multi-contact relays. The connector shown in Figs. 8 and 12 is in the form of a standard connector and unwanted circuits being indicated. The lower part of Fig. 12 shows a part of a flight circuit associateed with the giving of information to operators of the state of the flight sector switches upon which bookings of accommodation are registered.

Fig. 13 shows the controller's indicator setting circuit of which there is only one in the whole equipment.

The connections shown in Fig. 13 with a divergent arrow along the dotted line indicated by the Greek letter theta, are connected in common to similar points in the circuits of all controllers.

Fig. 14 shows the allotter, of which there is only one in the whole equipment.

Fig. 15 shows parts of three connectors serving a given operator, associated with three consecutive flights on a certain route and date, the middle one being associated with the "Preferred" flight on that date.

This figure is intended to be substituted for Fig. 8 and illustrates the operation of the connectors when an operator is searching for a flight with the required accommodation, by means of the "Advance-Regress" key.

Parts of the connector circuit not connected with this function are omitted.

Fig. 16 shows a modification of an operator's circuits and consequential modifications of a flight circuit to avoid mistakes as to the month, which is being dealt with, when a month has expired and the flight circuits are re-set to a new month.

Fig. 17 shows the "Book" and "Cancel" circuits of a controller's position.

Fig. 18 shows the booker which is common to the whole apparatus in the sense that there is only one of them serving all operators.

Fig. 19 shows the manner in which the figures should be fitted together to illustrate the circuits operated by a booking clerk.

Fig. 19A shows the method of fitting the figures together to illustrate the operation of the circuits, the connectors in particular, when searching amongst flights by use of the "Advance-Regress" key, Fig. 15, hereinbefore referred to, being used for the purpose.

Fig. 20 shows the manner in which the figures should be fitted together to illustrate the circuits operated by a controller.

Figures 21 to 29 inclusive are wholly concerned with interconnections between Figs. 6 to 18 inclusive, to make up the composite pictures formed by the assemblies of the figures indicated in Figs. 19, 19A and 20 and common or multipled connections are indicated thereon.

The connections are given reference numbers where they enter and leave a figure and these numbers are repeated on the figures showing the circuits.

Connections marked with arrows along the said lines are connected in common to similar points on the connectors, associated with a given flight, serving all operators having access to that flight. Therefore each flight circuit has a connection from each of these points to as many connectors as there are operators. Points marked with a single arrow are superfluous in the case of connectors serving booking clerks as the connections lead nowhere. Similarly the connections leading to relay contacts *cc1* to **28** inclusive on the right of Fig. 12 are superfluous in the case of connectors serving controllers.

General circuit description

The preferred embodiment will now be described in greater detail in relation to the Figures 2 to 29 inclusive, Fig. 1 having already been adequately explained.

In this description relays are given letter references. In referring to the relay capital letters are used. Relay contacts are numbered and in referring to relay contacts the relay letter reference is used, in italic lower case, followed by the serial number.

Banks of multi-bank switches are referred to be a letter reference characteristic of the switch, followed by a number indicating the bank referred to. References to individual contacts on a bank are referred to by the bank reference followed by "contact No.—."

Self-interrupting contacts on a stepping switch are referred to by the letter reference of the switch followed by letters *"dm,"* and the operating magnets of such switches are indicated by

the switch letter reference followed by the letter "M."

The same conventions are usd in the figures except that letter references are not repeated against relay contacts.

Referring to Fig. 2, showing in schematic form the circuits operated by a booking clerk, the operation of a number of route, month and date keys and their associated relays, shown on the left of the large frame half-way down the figure, and marked, "A Booking Clerk's Circuit" causes a route switch to hunt for the appropriate outlet to the connector leading to the preferred flight on the desired route and date.

These circuits are bracketed together under a heading "Flight Selection Circuits."

There is one route key for each route, one route switch and associated drive circuits for each route, and one set of month and date key and relay combinations for the whole position, which controls the stepping of the route switches to the contact leading to the connector associated with the preferred flight on a route and date.

On reaching this contact, the C relay of the connector concerned, is operated, operating relay CC which in turn closes a number of circuits which are shown in skeleton in the rectangle, marked "A Connector."

The next action is to operate the keys of the end airports of the required journey, causing the operation of sector relays, indicated in the booking clerk's circuit under the heading "Space Available Checking Circuits" which connect up the sector space availability relays for these sectors only. Contacts of these relays are distributed amongst the various circuits to confine operations to the required sectors.

Throughout this figure, seven sectors are illustrated for a flight as being the maximum envisaged. Shorter flights will be catered for by modification to the apparatus or pseudo-bookings to fill up the unwanted sector apparatus.

On operating space keys, and subsequent operation of associated space-required relays in the sectors with which the enquiry is concerned, the "Space Available," or "Space Unavailable" lamp will light according to the position of the sector switches in the flight circuits concerned. The operation of the space relays (top right of booking clerk's circuit) and space availability checking relays (centre of booking clerk's circuit), is not obvious from this figure but will be apparent from the complete circuit description to follow.

If the space is available and a booking is to be made, the operation of the book key operates the allotter if it is not already in use. The means of preventing intrusion on the alloter when in use by another operator is not shown at this stage.

A contact on a rotary switch SAL to each of whose contacts one operator is connected, is marked over a connection in the clerk's circuit and the switch steps round to that contact where it stops on a relay TAL operating to break the drive circuit.

At this point, provided the booker switch BS is free (i. e. at rest on its No. 1 contact), a series of relays in the clerk's circuit (exemplified by one of them, the relay N) will operate to complete the circuit of the clerk's impulse relay BPR. The booker will then drive automatically over a self interrupting circuit (not shown) connected to one of its banks and at every step will operate BPR via its self interrupting contacts. As the booker switch steps round, a series of ten book-

relays, B10R to B1R, in the booker will operate in that order, and each will remain operated during a number of steps corresponding to the number of the relay and corresponding operations of BPR will cause the stepping of the sector register switches in the flight circuit concerned, for a number of steps governed by the space relay operated in the clerk's circuit.

The correct sectors are selected by contacts of the sector relays conditioned previously by operation of airport keys.

After passing its tenth contact the booker switch breaks the impulsing circuits and drives home.

Any operator waiting will now be able to use the booker on the arrival of the booker switch at contact No. 1.

Fig. 2 is a simplification of the actual circuits used, and necessarily omits many vital stages and detailed facilities to be explained in the detailed circuit description which follows.

Referring to Fig. 3, showing, in schematic form, the circuits operated by a controller, the operation is analogous to that described in relation to Fig. 2 except that the controller receives an exact indication of space available on a flight by means of numerical indicators set by an indicator setting circuit, the working of which is similar to that of the booker except that the impulses, in this case provided by a relay DPR, are returned from the flight circuit switches to the indicator windings on the controller's circuit, the number of impulses being governed by the position of the wipers on the third and fourth banks of the sector switches rather than by space relays as in the case of the booking operation described in relation to Figure 2. An additional relay D in the connector, is required to connect the indicator circuits.

Another difference between Figs. 2 and 3 is that the controller can book up to 10 seats at a time whereas the clerks are restricted to four. Having no space relays, the booker impulses are regulated by the space keys directly, in the case of a controller.

In both Figs. 2 and 3, the important feature whereby an operator can investigate flights other than the preferred flight of a day, by use of the advance-regress key, is omitted for simplification but will be described later.

Detailed circuit description—Booking clerk's circuits

From this point, the description will move from one figure to another as indicated from time to time and they should be initially arranged as in Fig. 19 and read together as one figure.

Booking clerk—Examining for space available, route, month and date

To operate the equipment, a booking clerk depresses the appropriate route key R1K, R2K etc. (Fig. 6).

Not all the route keys are drawn in Fig. 6, R3K to R5K inclusive being omitted to simplify the drawing. Connections normally made through contacts of the omitted keys are indicated by dotted lines. The contacts and connections of the omitted keys are similar to those of R2K.

Information of the destination and ports of call of the various routes may be marked on the panel opposite the appropriate route and airport lamps, or may be on a notice board in sight of the operator or may be memorized by the operator.

Suppose, for instance, R1K is chosen, route 1 being required.

A battery+ path is prepared for relay MR, over R1K2, R2K1, etc., to R6K1.
Battery+ is applied via R1K4, R2K3, R3K3, etc., to R6K3, and connection 46 to relay R1R in Fig. 7.
R1R is one of a series of route relays (R1R, R2R, etc., to R6R), one of which is associated with each route key.

These last-named relays are each associated with a route switch circuit of which each operator has one for each route. Only one route switch, R1S associated with route 1, is shown with its circuit, in the dotted line rectangle on Fig. 7. The others are similar and the incoming connections shown with arrows round the margin of the said rectangle are multipled to similar points on all route switches in an operator's circuit. The connection 46 is not of course multipled as corresponding connections from the different route keys lead to the different route switch circuits.

R1R operates provided not more than one route key at a time is operated, otherwise the battery path for the relay is broken by disconnection of the No. 3 springs of the other route key operated.

Operation of contacts *r1r2*, shown on Fig. 7 prepares a driving path for route switch R1S, to be described later. There are three month keys, shown on Fig. 6, catering for a three months booking period, named M1K, M2K and M3K, and representing respectively the months, January, April, July, October, for the first; February, May, August, November, for the second, and March, June, September, December, for third.

Suppose that the third month of the period is required, M3K will be operated. M3K2 springs complete the battery+ path for

Relay MR, via R1K2, R2K1, etc., to R6K1.
M1K3, M2K3, M3K2 and MR operates.
M3R (Fig. 7) now operates over connection 49 M3K4, *mr1*.

Contacts *m3r1*, shown in Fig. 7, prepare a battery+ path to the wiper of the fifth bank of the route switch concerned, the function of which is to connect the operator to a connector circuit associated with a flight on the required date. The switches and their method of operation are described later.

If more than one month key is depressed, relay MR will not operate, there being no through path for the battery+ connection to the relay, beyond R6K springs, when more than one month key is operated. For instance in the example chosen for illustration, the accidental operation of M1K as well as M3K, breaks the path of M1K3, and though M1K2 takes up the connection dropped at M1K3, this connection is broken at M3K1.

A date "tens" key is next operated. These date keys appear on Fig. 6 named DT0K, DT1K, DT2K, and DT3K, (DT0K being operated for dates below ten).

Suppose, for example that the twenty-third day of the month is required, DT2K will be operated, preparing a battery+ path for relay DR, via DT3K1, DT2K2, DT1K3, DT0K3, and thence, later via springs of the date unit keys. If a second date tens key is operated, this path would be incomplete, for instance, in the example chosen, operation of DT3K would break it at DT3K1 and DT1K or DT0K would break the path at DT1K3 or DT0K3.

DT2K4 prepares a battery+ path for relay DT2R (operation of DR will, in due course, complete this path at *dr1*).

A date "units" key will next be operated. There are ten of these named DU0K, DU1K to DU9K. In Fig. 6 date units keys DU4K to DU8K inclusive, are omitted to simplify the drawing.

Their contacts and connections are similar to those of DU3K, connections from one key to another, normally made through contacts of the omitted keys, being indicated by dotted lines.

In the example chosen for illustration, DU3K will be operated, DU3K2 completes the operating path from battery+ for relay DR (via Number 1 springs of all date units keys to the right of the one operated (in Fig. 6) in series, DU3K3 and the Number 3 springs of each of the lower numbered date units keys to the left of the one operated, (in Fig. 6) in series). DR then operates and completes DT2R operating path, via DT2K4, DT3K3, *dr1*.

The route switches (R1S, R2S, etc., one of which is shown on Fig. 7, of which there is one per route per operator's position), are 50 point rotary switches of the "Uniselector" type, each having 5 banks. Bank 1 is used for "homing," bank 2 for "marking," and of banks 3, 4 and 5, one is associated with each of the three months of the booking period. There is one contact allocated for each day of the month, the remaining contacts above the thirty-first, being left unconnected except on the first bank where contacts 2 to the end are interconnected to form a "homing" circuit. In Fig. 7 the switches are shown as having only 31 contacts to simplify the drawing. On the second bank the contacts may be considered as grouped in four batches (according to the tens unit of the date), 1 to 9 inclusive, 10 to 19 inclusive, 20 to 29 inclusive, 30 and 31. The first group contacts are connected to separate contacts of the relay DT0R (since they represent dates of which the tens digit is considered as zero), the other sides of these contacts are connected to the No. 4 springs of the appropriate date units key. Similarly, the second group contacts of R1S2 are connected to separate contacts of DT1R, the third to contacts of DT2R, and the fourth group to contacts of DT3R. (Two only in this case, representing the 30th and 31st days of the month.) These contacts appear on Fig. 6 and the said groups appear on separate horizontal rows on a level with their respective relays. There are 31 contacts of these relays and, as explained, each pair of contacts is connected to a separate contact of R1S2.

31 connections numbered 51 to 81 inclusive take these 31 relay contact connections from Fig. 6 to Fig. 7 where they are grouped in a bracket indicating their connection to the various contacts of R1S2.

In the example chosen for illustration DU3K will be operated extending a battery+ connection derived from DU9K3, and passing via No. 3 springs of intermediate date unit keys, and via DU3K4, to *dt0r3*, *dt1r13* and *dt2r23*. Depending on which of these contacts is closed, the battery+ connection extends to the 3rd, 13th, or 23rd contacts of R1S2 (on Fig. 7) via connections 53, 63, or 73 respectively. In the example DT2R is operated so the battery+ connection goes to the 23rd contact of R1S2, via connection 73.

The date tens relay contacts, in their groups as previously described are connected similarly, in common, to all the route switches serving a par-

ticular operator's position (as indicated by divergent arrows on the connection from the bracket to R1S2 on Fig. 7), but only the switch of the required route can operate since the wipers of the second or marking bank and the driving circuit to be described later, are broken by contacts *r1r2*, *r2r2*, etc. of the corresponding route relays R1R, R2R, etc. and only the required route switch has its operative circuits connected at these points. Relay DR (Fig. 6), also operates via No. 1 springs of any date tens key above in number the one operated (and to the right of it in Fig. 6), No. 2 springs of the one operated, No. 3 springs of any below in number the one operated (and to the left of it in Fig. 6), No. 1 springs of any date unit key above in number the one operated (and to the right of it in Fig. 6), No. 2 springs of the one operated, and No. 3 springs of any below in number the one operated (and to the left of it in Fig. 6). The operation of DR thus takes place as soon as both a date tens and a date units key are operated together. Operation of more than one of either or both breaks the circuit. The operation of DR completes the drive circuit of the route switch (R1S in the example), via R1S winding (shown R1SM), R1S *dm*, *r1r2* front, *s2* back, *t1* back contacts, connection **50** (to Fig. 6), *mr2* front, *dr2* front contacts.

R1S then drives itself by its self-interrupting contacts R1S *dm* and hunts for the marked contact on its second or marking bank.

On reaching the marked contact, relay T operates, over *s1* back, *r1r1* front contacts, wiper of R1S2, marked contact **23**, connection **73**, *dt2r23* front contact, DU3K4 and other date units keys to the battery+ connection at DU9K3, in Fig. 6.

On operation of T, the drive circuit of R1S is broken at *t1* and at the same time an operating path is provided over connection **172**, crossing Fig. 25 to Fig. 8, for relay C in the connector, shown in Fig. 8, associated with one of the flights of the date and route required. This relay C operates via connection **172**, marked contact **23** and wiper on R1S (5th bank), *m3r1* front, *t1* front contacts, connection **50**, *mr2* front and *dr2* front contacts. The connection is made through the 5th bank of R1S (R1S5) and *m3r1* since, in the example chosen for illustration, the third month key (M3K) has been operated.

There will probably be several connectors each associated with one of several flights on any one day, and as there is only one contact on the banks of a route switch for each day, the contact for any date is connected to only one of such connectors, being the connector associated with the preferred flight for that day. The details of the connector circuits will be described later, but it may be explained at this stage that the principal components of each of them are 3 relays, a master relay C having 19 contacts one of which operates a relay CC (Fig. 12) having 41 contacts one of which operates a relay D having 14 contacts, which make connections between an operator's circuit and the flight in which he is interested, and ensure that subsequent operations are directed to such flight.

Another relay OE not concerned with these functions, completes the equipment of a connector, a specimen of which is shown in the upper halves of Figs. 8 and 12 above the dotted lines indicated by the Greek letter, phi.

Any of these relays may be replaced by two or more of relays to avoid having relays with excessive numbers of contacts.

As already indicated, the D relay is concerned only with controllers' space available indicator setting circuits and is superfluous in connectors serving booking clerks. Similarly 28 of the contacts of CC are concerned with booking clerks space available indication which works with lamps instead of indicators and contacts *c7*, *c6*–*c10* and *c18* of relay C superfluous in connectors serving controllers, since the last-named group of contacts control the lamp indicators at booking clerks' positions.

On the operation of C, relay S (on Fig. 7) operates over connection **165** crossing Fig. 25, *c5* (Fig. 8), releasing T at *s1* (Fig. 7) and preventing (by open circuit at *s2* (Fig. 7)), the restoration of the drive circuit of the route switch which would otherwise be reconnected at *t1*, on the release of T. *s2* contacts also provide a holding circuit for relay C via *c1* front, *oe3* front or back contacts, connections **159** or **161** crossing Fig. 25, *er3* and *or3* back contacts, *s2* front, *t1* back contacts, connection **50** crossing to Fig. 6, *mr2* front, *dr2* front contacts to battery+, the original operating circuit for the relay C being broken at *t1*, on release of T.

On the operation of C, the route, month and day lamps light according to the corresponding keys which have been operated and the flight lamp corresponding to the preferred flight on the day in question, will also light. These lamps are shown on Fig. 7. (The circuits are completed by *c6*, *c7*, *c8*, *c9* and *c10*) over connections **167**, **168**, **169**, **170** and **171**.

If the "Busy-Free" key in or associated with the flight circuit concerned, shown at the bottom of Fig. 8, is in the "Busy" position the "Flight Unavailable" lamp (Fig. 9) will also light, via busy-free key 1, *c18*, and connection **39** crossing Figs. 25, 24 and 23 to Fig. 9.

This key is under the control of a controller who can bar any journey from access on the part of the booking clerks, during the "setting-up" of a flight, its "clearance" after departure or for any other reason.

The flight lamp of the preferred flight for the date required, having lit, the operator knows that he has been connected to the preferred flight for that date, but does not yet know whether or not there is any space available on that flight.

The C relay of the connector, over contacts *c11* to **17** and connections **82** to **88** crossing Figs. 25, 24 and 23 to Fig. 9, prepares operation paths for a series of sector barring relays B1.2A, B2.3A etc. to B7.8A, in the operator's circuit (Fig. 9), each of which is associated with a sector of any flight under examination, (it being assumed that the equipment provides for journeys of not more than 8 ports of call, and therefore 7 stages or sectors) but these sector barring relays will not operate if their corresponding barring jacks in the flight circuit under examination, of which there is one for each sector of the flight, are plugged up. The barring jacks are shown at the bottom of Fig. 8. A controller can plug up any sector of a journey for which bookings are to be prohibited. Short stages on long routes, and stages wholly in countries who claim a monopoly of internal travel are examples of sectors which may be barred, as previously explained.

The B1.2A, B2.3A etc. relays, at *b1.2a1*, *b2.3a1* etc., prepare an operating path for the subsequent operation of relay BAR of which there is one for each operator's circuit. The operators' barring circuits are shown in Fig. 9.

Booking clerk—Examining for space available, sector selection and barred journeys

The next stage in the operation fo the equipment is the operation of the "Airport Keys" associated with the end airports of the required journey. The equipment described is fitted to cater for journeys having a maximum of 7 stages (or "sectors" as they are herein called). There are therefore 8 airports involved and 8 keys are provided. These are named K1P, K2P, K3P, etc.,–K8P, (Fig. 9).

Suppose, to continue the example, the enquiry relates to the first two sectors of a route. K1P and K3P will be operated.

RKP operates over K8P3, K7P5, K6P5, K5P5, K4P5 (not shown), K3P4, (operated), K2P3, K1P2 (operated). The operation of a third airport key or one key only, breaks this circuit. As another example, if K2P and K8P are operated, RKP operates over K8P2 (operated), K7P3, (K6P3, K5P3, K4P3 not shown), K3P3, K2P2, (operated) and K1P1.

A pair of RKP contacts is connected in series between each of a number of sector relays and its connection to the airport keys. These relays, which are named R1.2P, R2.3P, R3.4P, etc. to R7.8P, (R4.5P, R5.6P, and R6.7P being omitted for the same reason as in the case of corresponding airport keys as explained above), are connected to the airport keys (via contacts *rkp*1, *rkp*2, *rkp*3 etc., to *rkp*7 respectively, as aforesaid), in such a manner that the operation of any two airport keys causes the operation of the relays of the sectors between those airports. In the first example above (K1P and K3P operated), R1.2P operates over *rkp*1 front contacts and K1P2, whilst R2.3P operates over *rkp*2 front contacts K2P3, K1P2.

In the second example (K2P and K8P operated) R2.3P operates over *rkp*2 front contacts, K2P2, K1P1; R3.4P operates over *rkp*3 front contacts K3P3, K2P2, K1P1; R4.5P, R5.6P, R6.7P, also operate over the same path as R3.4P, plus their individual *rkp* contacts and K4P3, K5P3 and K6P3 (not shown) respectively whilst R7.8P operates over *rkp*7 front contacts K7P3, and thence as for the other sector relays. Had K7P been operated instead of R8P, R7.8P could have found no operating path. Each of the sector relays R1.2P, R2.3P etc. has three sets of contacts, the first, *r*1.2*p*1, *r*2.3*p*1 etc., are associated with the "barring" facility to be described, the second, associated with booking clerks' space available indicating circuits, and the third, associated with the booking circuits. In general terms, the function of these relays is to confine clerks' enquiries, and all bookings, to the required sectors of a flight.

The first choice of sectors, used above to explain the working of the airport keys sector relays etc., namely from airport 1 to airport 3, will be used to continue the example.

The operation of R1.2P and R2.3P completes a path either via *r*1.2*p*1 and *b*1.2*a*1 or via *r*2.3*p*1 and *b*2.3*a*1, or both, for the operation of the relay BAR provided that both the sectors are not "barred" by the plugging of the corresponding barring jacks in the flight circuit concerned, which would prevent the operation of the corresponding barring relay (B1.2A etc.), since the battery+ connection for these relays is obtained via connections 82 to 88 inclusive, contacts *c*11 to *c*17, inclusive, inclusive, of the connector in use, the barring jacks in the flight circuit and the busy-free key.

It will be seen that in multi-sector journeys, BAR will operate, unless all the sectors are barred, since any one pair of the relay contacts *b*1.2*a*1, *b*2.3*a*1, etc. relating to sectors included in the required journey, will provide an operating path to battery+ via the corresponding sector relay contacts (*r*1.2*p*1, *r*2.3*p*1 etc.). It is deliberately arranged that only the barring of all the sectors included in a particular journey shall prevent the operation of the relay BAR as it is not intended that the barring of intermediate sectors shall bar longer journeys including barred sectors. In the event of it being found necessary to prohibit bookings on a number of individual sectors which are consecutive, the use of the barring facility for these sectors would have the undesired effect of preventing enquiries and bookings for journeys consisting of those sectors. To overcome this disadvantage would involve certain complications to the apparatus which are considered to be unjustified in view of the improbability of such cases arising. Several factors contribute to this view. In the first place, short journeys with heavy bookings are normally handled by different clerks from those dealing with the long routes, and the use of the barring facility will normally be confined to special cases. Also, on long routes, it will not be usual to accept bookings for journeys adequately covered by shorter services and the barring of a number of individual consecutive sectors can be tolerated without detracting from the utility of the installation. Any doubtful case will, in any event, be referred to a controller, who can over-ride the bar if expedient, and make the booking himself.

If BAR should fail to operate for reasons stated the operation of relay RKP (on depressing the airport keys) will complete an operating path for the "Journey Barred" lamp shown on Fig. 9, via *bar*1 back and *rkp*8 front contacts.

If BAR operates (i. e., journey not barred) *bar*2 front contacts prepare battery+ path for relay AVR on Fig. 10, via a chain of *r*1.2*p*2, *r*2.3*p*2 etc., contacts in parallel with *r*1.2*a*, *r*2.3*a* etc. 1, contacts, the former being normally closed and the latter normally open.

The connections between these sets of parallel relay contacts pass along connections 8 to 21 inclusive, which cross Figures 21 and 22 between Figs. 9 and 10.

On Fig. 10, only R1.2A and R7.8A are shown, the intermediate relays R2.3A, R3.4A, R4.5A, R5.6A and R6.7A and their contacts, which are similarly connected being omitted to simplify the drawing. Of these sets of parallel contacts, the *r*—*p*2 contacts of sectors outside the proposed journey were left unoperated on operation of the airport keys K1P, K2P etc., and these contacts leave a path through the parts of the AVR relay operating chain corresponding to these parts of the journey, (in the example chosen *r*3.4*p*2, *r*4.5*p*2, *r*5.6*p*2 and so on). As to the portion of the AVR operating chain corresponding to the required journey, the path via *r*1.2*p*2, *r*2.3*p*2 contacts (referring to the journey chosen for illustration) is opened on operation of these relays and the AVR relay operating path will be broken unless *r*1.2*a*1 and *r*2.3*a*1 contacts are closed by operation of their relays. This will cause the "space unavailable" lamp to light on the operator's panel (via *avr*1 back, *bar*1 front, *rkp*8 front contacts).

To cause AVR to operate and light the "Space Available" lamp, *r*1.2*a*1 and *r*2.3*a*1 must be operated and it is arranged in a manner to be explained later that this shall happen so long as

at least one seat is free on the flight in question for the sectors included in the required journey (in this instance sectors 1—2 and 2—3). It will be remembered that when the route and date had been keyed by the operator, the C relay of the connector circuit associated with the preferred flight on that route and date, operated (and this irrespective of the availability of the flight), contacts *c*19 causing relay CC to operate and close contacts 1 to 28 of relay CC (shown in Fig. 12, four to each sector of the flight). This may or may not operate the R1.2A, R2.3A, etc., to R7.8A, relays, as will be explained later. Had the flight been unavailable or the journey been barred, nothing further would have resulted from this as BAR (Fig. 9) would have failed to operate and the normally open *bar*2 and *bar*3 contacts would have nullified all further attempts by the operator to go ahead ignoring the lamps.

If all has gone well up to this point BAR will have operated (which coincides with the keying of the beginning and end airports of the journey) and the prior operation of the CC relay and the closing of its *cc*1 to *cc*28 contacts becomes of importance since they closed a path for the operation of the R1.2A, R2.3A to R7.8A relays of all the sectors of the flight concerned, over connections 97 to 124 inclusive, crossing Fig. 24, from Fig. 12 to Fig. 10.

Each flight circuit is provided with a number of sector switches concerned with the registration of bookings on the various sectors and the signalling of information about the state of those bookings. It will be remembered that a flight represents a journey by an individual aircraft on a given route on a given date, at a given time of day. The number of sector switches in each flight may be a standard number, for instance seven, as in the embodiments being now described, or, in certain circumstances for well-established services, the flight circuits may be specially made with the exact number of sector switches required for the such services.

The sector switches are named 1.2S, 2.3S, 3.4S etc. to 7.8S and one of them, 1.2S together with part of another, 7.8S, is shown at the bottom of Fig. 12.

The sector switches are rotary switches of the "uni-selector" type and 4 banks are used, No. 1 for "homing," No. 2 for giving space available information to booking clerks and Nos. 3 and 4 for setting controllers "Space Available" indicators.

It is proposed to use a 25 contact switch to represent a 24-seat aircraft, No. 1 contact being utilised as a rest or "home" position of the switch. Larger aircraft will be catered for by using a larger switch and in both cases, aircraft of less accommodation than the total capacity of the switch will be adapted to the equipment by a controller making a pseudo booking of the excess number of places.

It may be desirable in certain circumstances, to use two or more 25 contact switches in cascade, instead of a larger switch, to accommodate planes with more than 24 seats, and this may be accomplished by circuits well known to the telephone art, to start another switch on completion of bookings on the previous one.

The sole function of the second banks of the sector switches, is to signal information to booking clerks of the state of bookings.

Booking clerks may only book four seats at a time as a maximum and therefore only require to know whether one, two, three, or four seats are available. Any switch with the wiper standing on contacts 1 to 21, has four or more seats vacant, (No. 1 contact, the "rest" position of the switch, representing an empty aircraft, and contacts 2 to 21 inclusive, the first 20 seats of a 24-seat machine). A switch standing on contacts 22, 23, 24 and 25 represents a machine with 3, 2, 1 and zero seats available.

The position of the switches governs the operation of the relays R1.2A, R2.3A etc. for the required sectors of the flight and these relays must operate to give the "Space Available" indication.

Therefore, as contact 25 represents a full aircraft, the R1.2A, R2.3A etc. relays must not operate when the wiper stands upon contact 25. Contact 25 thus is accordingly left unconnected.

Contacts 24, 23 and 22 are separately wired, and contacts 1 to 21 are strapped together and led from the switch on a fourth wire.

These four wires from each sector switch are wired in common to seven sets of four CC relay contacts, in the connectors, associated with a given flight, serving all booking clerks having access to that flight.

The R1.2A, R2.3A, relays in a booking clerk's circuit each have four windings, joined in parallel on one side to battery—and separately, on the other sides, to the said sets of four CC relay contacts (*cc*1–*cc*4, to *cc*25–*cc*28) in common in all connectors serving a given clerk. Three of these connections are broken by contacts of relays S1R, S2R and S3R which are normally open. These circuits can be traced from the R1.2A, etc., relays on Fig. 10, over connections 97 to 124 crossing Fig. 24, via the related *cc* contacts, viz, *cc*1–*cc*28 on Fig. 12, to the sector switches below the dotted line marked with the Greek letter phi on Fig. 12.

When the CC relay of a connector is operated, the four windings from each of the relays R1.2A, R2.3A, etc., are connected to the contacts 24, 23, 22 and 1 to 21 (strapped together) on the corresponding sector switches (1–2S2 and 7–8S2, shown in Figure 12), the first three from each relay being broken by contacts of space relays S1R, S2R and S3R respectively.

These space relays are all operated when BAR operates, via space key springs S2K3, S3K3, S4K1, connection 24 crossing Figs. 22 and 21 to Fig. 9, *bar*3 front contacts, connection 23 crossing Figs. 21 and 22 to Fig. 10, *sa*1 back contacts, for S1R and similar paths but through fewer space key springs, for S2R and S3R.

Therefore, provided that no sector switch for a sector included in the required journey stands on its 25th contact, the relays R1.2A, R2.3A etc. corresponding to those sectors, will each operate over one of their four windings, immediately after the operation of BAR, from the battery+ connections on the bank 2 wiper of the sector switches.

This indicates that there is at least one seat available for the whole journey, and the AVR relay operating chain is completed in manner previously explained and the space available lamp will light over *avr*1 front contacts, connection 7 crossing Figs. 22 and 21 to Fig. 9, *bar*1 front, *rkp*8 front contacts.

If one of the sector switches had stood on contact 25 the corresponding R—A relay would have failed to operate and if the sector in question formed part of the required journey, the AVR relay operating chain would have been broken at the No. 1 contacts of that relay. This

would have caused the space unavailable lamp to light over *avr*1 back contacts, connection 7 crossing Figs. 22 and 21 to Fig. 9, *bar*1 front *rkp*8 front contacts and this would coincide with the operation of BAR.

If it is desired to enable booking clerks to deal with enquiries and bookings, of more seats than four, at a time, the R1.2A, R2.3A etc. relays would have to have correspondingly more windings or be replaced by several relays with their contacts in parallel, the sets of four CC relay contacts (*cc*1, 2, 3, 4 etc.), would have to be correspondingly increased, more space keys would be required, more space relays S1R, S2R, etc., would be required and the number of wires leading from the second banks of the sector switches, would have to be increased.

Booking clerks—examining for space available, space (required) keys

Assuming that the booking clerk has now obtained an indication from the "Space Available" lamp that at least one seat is available for the whole journey he will now operate the appropriate "space" key. On the equipment described, there are 4 of these at a booking clerk's position, called S1K, S2K, S3K and S4K and they are shown at the top left of Fig. 10.

Suppose that 3 seats are required. The operation of space key No. 3, S3K, breaks the battery+ path to relay S2R at S3K3 and for all S—R relays below that (S1R in the example quoted). In the example quoted, relays S1R and S2R release, breaking the operating path of the R1.2A, R2.3A, etc., relays of the journey concerned, at the *s*1*r*1 contacts respectively. This will cause the release of any of the R1.2A, R2.3A, etc., relays, corresponding to any sectors in the flight, where the No. 2 bank wiper of the sector switch has progressed beyond the 22nd contact. If this is the case for any sector of the journey concerned, the release of the R—A relay for that sector will break the operating path of relay AVR, extinguishing the space available lamp and lighting the space unavailable lamp.

Lower numbered space keys can be operated in turn causing the re-operation in turn of S2R, and S1R until AVR again operates. It is, of course, already known because initially, the space available lamp was lit that one seat is available for the whole journey.

Booking clerks—examining for space available, searching different flights

If the required number of seats is available, and the booking is confirmed by the customer, the clerk operates the "Book" key (right side of Fig. 10) the effect of which will be described later.

If the required number of seats is not available, the customer will wish to know whether he can be accommodated on another plane on the day in question. The clerk has an "Advance-Regress" key with two positions. This key is shown on Fig. 7, as two separate keys, an "Advance" key ADK and a "Regress" key, RGK, which simplifies the drawing.

The method whereby a search can be made amongst other flights consists of the bringing into operation of successive connectors, step-by-step as the advance-regress key is operated. Though Fig. 7 shows two separate keys, in practice, a two way non-locking key is used, one way for advance, one way for regress. Only one flight for any day is connected to the route switch, of which the third, fourth and fifth banks are connected to connector circuits associated with flights in the first, second and third months of the booking period, individual contacts corresponding to the days of the month. It has been previously described how the correct bank of the route switch was connected at *m*1*r*1, *m*2*r*1 or *m*3*r*1 by the month selector keys and how the route switch advanced to a marked contact (selected on the second bank by the date tens and date units keys and relays) and then stopped and placed battery+ potential (via the wiper) on a contact on which it stopped on the third or fourth or fifth bank. This contact represents a certain day of the month on which there will usually be several flights and the contact is connected to the connector associated with one flight on that day, being the preferred flight, over connection 172 on Figs. 7, 25 and 15.

Access to the other flights can only be obtained by the advance and regress key. The placement of Figs. 6, 7, 25 and 15, as shown in Fig. 19A will render clear the understanding of the advance and regress facility.

On the stopping of the route switch, the connector concerned with the preferred flight for the date in question operates its C relay. (In the example described this was over connection 172 on Figs. 7, 25 and 15, R1S5 twenty-third contact and wiper *m*3*r*1 front, *t*1 front contacts, connection 50 crossing from Fig. 7 to Fig. 6, *mr*2 front and *dr*2 front contacts.)

Contacts *c*'5 operate the relay S in the operation circuit, over connection 165 crossing Fig. 25 to Fig. 7. Contacts *s*1 change over releasing T and locking S via *r*1*r*1 front contacts R1S2 wiper and 23rd contact to *dt*2*r*23, DU3K4 and other date units keys of higher numbers to battery+ on DU9K, this being the circuit which previously held T. Relay C' locks via *c*'1, *oe*'3, front contacts, connection 159, *er*3 back contacts, *s*2 front, *t*1 back contacts, connection 50 leading to Fig. 6, *mr*2 front and *dr*2 front contacts.

Relay OE' in the middle connector on Fig. 15 is operated over the path *oe*5 (left hand connector in Fig. 15), connection 166, *s*2 front, *t*1 back contacts, connection 50, *mr*2 front, *dr*2 front contacts and this is why the C' locking circuit goes through connection 159 and *er*3 instead of connection 161 and *or*3. Contacts *s*2 also connect positive battery via *dr*2, *mr*2, *t*1, *s*2 and connection 166 to the back contacts *oe*5 of all connectors associated with the operator in question. In each set of interconnected connectors individual to the flights of a particular route and date, the OE relay of the first connector has no connection and cannot operate so that its *oe*5 contacts remain closed and allow the relay OE of the second connector of the set to operate. Thus in Fig. 15, if the left hand connector is associated with the first flight of a day, OE will be disconnected, and its contact *oe*5 will be unoperated, and OE' of the middle connector will operate over the path *oe*5, connection 166, *s*2, *t*1 connection 50, *mr*2, *dr*2.

Contacts *oe*'5 of the middle connector open the circuit of the relay OE'' of the right hand connector so that this relay will not operate. As the relay OE'' of the right hand connector does not operate, that of the fourth connector will operate, and will in turn prevent operation of the relay OE''' of the fifth connector (not shown). In this way only the relays OE of the even connectors of a set individual to the flights of a particular route and date will operate.

It does not matter which of the connectors of a

set is "preferred" and has its relay C connected to connection 172, the operation of the OE relays will be the same.

This "odd" and "even" distinction between successive connectors and the purpose therefor is explained below. Relays ER and OR (Fig. 7) in an operator's equipment complete the process.

To continue the description of the process of searching for a free flight:

The operator now presses the advance key ADK and let it be supposed that the preferred flight for the date in question, is the one associated with an even numbered connector, where the OE relay will be operated. The centre connector in Fig. 15 can be considered as representing this connector. ER operates over *or*5 back contacts, connection 162 *oe'*4 front, *c'*2 front contacts, connection 160, *er*4 back, *or*4 back contacts and ADK3. On operating ER locks itself over its *er*4 contacts, connection 160, *c'*2 front, *oe'*4 front contacts, connection 162, *or*5 back contacts. Contacts *er*4 also remove the original operating path over ADK3.

At the same time C'' relay of the next connector, on the right of Fig. 15, operates over *c'*3 front *oe'*2 front contacts, connection 157, *er*2 front contacts, ADK5, RGK4. Relay C' of the "preferred" connector has its locking circuit broken at *er*3 but holds over *c'*1, *oe'*3 front contacts, connection 159, *er*3 front contacts, and ADK3, until the release of ADK. One operation of C'' the flight lamp of the next flight lights, the "preferred" flight lamp also remaining alight until the release of ADK releases C', when it goes out.

The release of C' and opening of *c'*1 bars the previous holding path for C' via back contacts *er*3, so that release of ER on the breaking of its holding circuit at *c'*2 does not cause C' to re-operate.

The connector associated with the next flight is now in the same condition as it would have been if it had been the preferred flight and the space available and unavailable lamps will light or not according to the state of booking in that flight.

If no space is available on this next flight the ADK key will again be depressed and here a similar routine will be gone through except that the flight is an "odd" flight, with OE'' unoperated. The operation of ADK now operates OR instead of ER and the sequence of events is as before with OR contacts substituted for ER corresponding contacts and OE contacts not operated. This circuit can be traced from—, OR, *e*R5 back, connection 158, *o*E''4 back (Fig. 15), *c''*2 front, *oe''*4 back, connection 160, *er*4 back, *or*4 back, ADK3 front, positive.

C'' holds, (first, when ADK is released after first operation, over *c''*1 front, *oe''*3 back contacts, connection 161, *or*3 back contacts, *s*2 front contacts etc.) then on re-operation of ADK, over *c''*1 front, *oe''*3 back contacts, connection 161, *or*3 front contacts, and ADK3.

C''' (not shown) operates over *c''*3 front, *oe''*2 back contacts, connection 163, *or*2 front contacts, ADK5 and RGK4 and subsequently holds as previously explained on release of ADK.

The sequence of connector operation continues with successive ADK operations till the flights of the day are exhausted or the required space is found.

Searching for previous flights causes exactly similar sequences except that RGK springs are substituted for ADK springs and RGK5 completes an operation path for the C relay of a

connector on the left instead of the right, via contacts *c'*4 front, *oe'*1 front contacts, connection 156, *er*1 front contacts and RGK5.

The "odd and even" system prevents the automatic operation of the connectors in rapid succession on depression of ADK which would tend to happen if operation of ADK set up operating paths which are similar in all connectors. In practice, it has proved difficult to devise a simpler circuit which did not behave in this way. The system described also enables a flight and its associated connectors (one for each operator) to be removed from the equipment without having to re-set all the other connectors to be alternatively odd and even. This is done automatically by the OE, ER and OR relays.

Booking clerk—booking

Having now discovered a flight having the required accommodation, and the booking being requested by the customer, the booking clerk now commences to book.

The figures should again be arranged according to Fig. 19. In the example chosen for illustration, these seats were required. Still holding down the appropriate "Space" key, (in this case, S3K) the operator will press the "Book" key, illustrated on the left hand side of Fig. 10.

This causes relay RKB to operate over *bm*1 back, *sa*2 back contacts, book key, S1K1, S2K1, S3K4, S4K1, connection 24 crossing Figs. 22 and 21 to Fig. 9, *bar*3 front contacts, Fig. 9, connection 23 crossing Figs. 21 and 22 to Fig. 10, *sa*1 back contacts.

RKB has five sets of contacts of which all but *rkb*4 prepare circuits subsequently to be completed, *rkb*4, however, closes an operating path for the magnet SALM of the allotter switch SAL, shown on Fig. 14, over SAL *dm*, *tal*1 back contacts, connection 5, crossing Figs. 21 and 22 to Fig. 10, *avr*2 front *rkb*4 front contacts, connection 128 crossing Fig. 24 to Fig. 12, *cc*29 front and *bf*1 back contacts.

There is only one allotter serving the whole installation and its major component is the switch SAL, which is a rotary switch of the "uniselector" type which drives by self-interruption over the said operating path until tripped by operation of the relay TAL.

The switch SAL has 3 banks, the first has connections from the various booking clerks' circuits to its various contacts, the second has connection from the various controllers' circuits to its various contacts. A marking condition is put on the contact of one or other of these banks whenever a booking clerk or controller commences to book on a flight not at the moment being booked upon. This marking condition is concerned with tripping the drive of SAL by operating TAL, as will be explained later.

The third bank of SAL has its various contacts connected to the various booking clerks' and controllers' circuits and is concerned with the operation of a series of relays enabling booking to proceed.

The "appearances" of a booking clerk on the first and third banks of SAL must be to like numbered contacts on each bank, and similarly in the case of a controller on the second and third banks. SAL must therefore have at least as many contacts as the maximum number of operators for which the installation is equipped and a series of switches may be used in cascade for installations beyond the capacity of a convenient size of switch.

The operation path for the drive circuit is led via contacts *cc*29 in the connector in use, to the flight circuit in which the operator is interested. The same applies (though over contacts *cc*30 of the connector in this case) a positive potential to the connections leading to the first or "marking" bank of SAL, and battery+ connection for both purposes are derived via contacts *bf*1 and *bf*2 respectively, in the flight circuit.

The path of "marking" bank potential, traced in detail, is as follows: SAL1 marked contact, connection 4, crossing Figs. 21 and 22 to Fig. 10, *avr*3 front, *rkb*5 front contacts, connection 127 crossing Fig. 24 to Fig. 12, *cc*30 front, *bf*2 back contacts. This enables the prevention of two operators booking on the same flight at once, by the operation of relay BF, as will be described in detail later. When SAL commences to operate, it drives automatically (under self-interruption at SAL *dm*) till SAL1 wiper reaches the marked contact whereupon TAL operates from the positive marking potential on the said contact, via wiper, and *cal*2 back contacts which interrupts the drive circuit of SAL, at *tal*1 back contacts, and applies the battery+ connection previously used to drive SALM, to relay SA of the operator concerned over the path, SA, (Fig. 10), connection 6, crossing Figs. 22 and 21 to Fig. 14, contact and wiper SAL3, *tal*1 front contacts, connection 5 crossing Figs. 21 and 22 to Fig. 10, *avr*2 front, *rkb*4 front contacts, connection 128 crossing Fig. 24 to Fig. 12, *cc*29 front and *bf*1 back contacts. SA relays of all operators are connected to the various contacts of the third bank of SAL. SA operates and locks, over *sa*5, *rkb*3, front contacts.

The contacts of SA now complete various connections from this booking clerk to the booker, to be described later. In the meantime BF (Fig. 12) operates, over *cc*31 of the connector in use, connection 126 crossing Fig. 24 to Fig. 10 and *sa*6 front contacts. There is a BF relay associated with each flight and it operates when an operator, interested in that flight and connected to it via his appropriate connector at *cc*31 is successful in operating his SA relay. Any other operator examining the same flight will be unable to start SAL hunting nor to place a marking condition on its contacts, nor to operate his SA relay, the battery+ path for all three being broken at *bf*1 and *bf*2 operated, and he will receive the "Booker Busy" signal on the lamp so named, on his panel, via *sa*7 back contacts, connections 125 crossing Fig. 24 to Fig. 12, *cc*32 front contacts in the connector in use, and *bf*3 front contacts in flight circuit concerned. By the operation of SA, the circuit of the "Booking Proceeding" lamp is completed via *sa*7 front contacts, connection 125 crossing Fig. 24 to Fig. 12 *cc*32 front and +*bf*3 front contacts to positive, and this lamp lights. TAL releases on operation of BF, being open circuited at *bf*2. Once this has happened, the allotter is free to search for another operator and, provided that no two operators are interested in the same flight, can operate, in succession, the SA relays of a number of them. Contacts *sa*1 being operated, put a holding condition on RKB over *bm*1 back contacts, and also provide an alternative operating circuit through another winding on each relay for any of the relays S1R, S2R etc., which are operated over their own No. 8 contacts; when the opening of *sa*1 back contacts breaks the previous holding circuit. The book key is isolated, by the opening of *sa*2 back contacts. The connections

38, 39, 40, 41 and 42 leading across Fig. 22 from the booker shown on Fig. 18 are connected in common to similar points in the circuits of all booking clerks' positions.

The operation of SA, causes relay N (Fig. 10) to operate, provided that the rotary switch BS in the booker is standing on contact No. 1, via *n*1 back, *sa*3 front contacts connection 41 crossing Fig. 22 to Fig. 18, BS2 wiper and No. 1 contact, in Fig. 18, connection 42 crossing Fig. 22 to Fig. 10, *sa*4 front and *bm*2 back contacts. N holds over *n*1 front, *rkb*1 front contacts.

Relay EB in the booker (Fig. 18) then operates over connection 40 crossing Fig. 22 to Fig. 10 and *n*2.

The operation of EB starts a stepping cycle in BS. BS is a rotary switch of the "uni-selector" type with three banks in use, BS1 for "homing," BS2 for control and BS3 for counting out seats to be booked, to the sector switches.

Immediately on operation of EB, a relay B10R operates over BS3 No. 1 contact and wiper, *bb*3 back and *eb*1 front contacts. B10R then holds over *b*10*rl*, *eb*1 front contacts. BA operates over *b*10*r*4 front contacts, BS *dm*.

BB operates over *ba*3 front contacts and on operation of BB two things happen simultaneously; first, BS advances a step, BSM being energised over *bb*1 front, *cz*1 back and *bz*1 back contacts; secondly, the BPR relay in the circuit of the booking clerk concerned (shown in Fig. 10), operates, over *n*4 front, connection 39 crossing Fig. 22 to Fig. 18 *bz*2 back, *cz*2 back and *bb*2 front, contacts (in Fig. 18).

The operations of BB apply battery+, over connection 39, to all operator's positions in parallel.

The stepping of BS breaks BA circuit (at BS *dm*) and this releases BB, at *ba*3. BB on releasing permits the BPR relay in the operator's circuit (Fig. 10) to release (*bb*2) and breaks the operating circuit of BSM (at *bb*1) which in turn allows BS *dm* contacts to close, again operating BA and recommencing the stepping cycle of BS and applying an impulse to BPR each time BS alights upon a contact.

BS as it progresses, operates in succession a series of ten relays named B10R–B9R to B1R starting with B10R (as already mentioned) and progressing to B1R, each relay holding (over its own No. 1 contacts), on operation.

In Fig. 18, intermediate relays of the series, namely B3R to B8R inclusive are, omitted to simplify the drawing. The contacts and connections of these relays are similar to those of B9R and each is connected to an individual contact of BS3.

Each of these relays has a pair of normally open contacts (No. 2), joined on one side to battery+ and on the other to connections 26 to 35 inclusive (B1R contacts over connection 35, B2R contacts over connection 34, and so on). These connections cross Fig. 22 to Fig. 10 and are connected in common to similar points on each operator's position; a booking clerk, since he is only required to book seats to a maximum of 4, has only 4 connections, (35, 34, 33 and 32) connected whilst a controller has access to all ten.

It has been seen that relay B10R operates and locks on the operation of EB, when BS is standing on, or arrives at its No. 1 contact. This relay remains operated during ten steps of the switch BS and consequently during ten operations of the relay BPR in the clerk's circuit.

When BS alights on contact 2, B9R operates

and remains operated during 9 steps of BS and during nine operations of BPR, likewise all the other relays of this series, operating in succession, remain operated during a number of BPR operations corresponding to their respective reference numbers.

Whilst BS traverses its first 10 contacts the said connections 26 to 35 are being connected to battery+ via contacts *b10r2*, *b9r2*, etc. respectively. These connections are maintained at battery+ potential during a number of operations of relay BPR corresponding to their respective reference numbers. The advancing of the sector switch is effected by connecting one of the connections 26 to 35, having a reference number corresponding to the seats required to be booked, to the drive circuit of the sector switch, via contacts of BPR. In the example chosen for the reservation of three seats, each time BPR operates, an impulse is passed to the sector switch and the number of such impulses is governed by the connection (of 25 to 35) to which the said circuit is connected.

Selection of the correct connection is effected by contacts of the space relays S1R, S2R, and S3R. It will be remembered that these relays all operate initially but are subsequently released or left operated according to the operation of space keys S1K etc. Operation of a space key releases all relays S1R, etc., whose reference numbers are below the reference number of the key operated but leaves operated all S1R, etc., relays with reference numbers equal to and above the reference number of the space key operated.

The contacts of these relays (S1R9, S2R9, S3R9) are therefore arranged so that the lowest numbered of them remaining operated, connects the circuit to one of the connections 26 to 35 communicating with the relay in the booker having the corresponding reference number and disconnects it from those communicating with relays having higher reference numbers.

For example, the operation of S2K leaves S2R and S3R operated, and releases S1R. Contacts *bpr1* are then connected to connection 34 and thence (crossing Fig. 22 to Fig. 18) to *b2r2*, but it is isolated from connection 35 at the open front contacts of *s1r9* and from connection 33 and 32 by the open back contacts of *s2r9*.

The operation of S4K releases all the space relays and connects contact *bpr1* straight through to connection 32 and thence across Fig. 22 to *b4r2* on Fig. 18, the relay contacts being as drawn in Fig. 18.

Beyond *bpr1*, in the other direction from the S1R etc. contacts, the circuit passes along connection 25 to Fig. 9 where it divides into seven parallel branches each passing through normally open contacts of the sector relays R1.2P, R2.3P etc., of which the ones corresponding to the sectors comprising the required journey, were operated as a result of the operation of airport keys (K1P, K2P etc.).

These seven branch circuits now pass along connections 90 to 96 inclusive crossing Figs. 23 and 24 to Fig. 12 and are connected to all the connectors serving a given operator where each is connected in common to one of the contact pairs *cc34* to *cc40* of the CC relay in each of these connectors.

The CC relay contacts *cc34* to *cc40* of the connector in use, extend the seven branches aforesaid to the seven sector switches of the flight circuit with which the connector is associated. The circuits are not passed through other connectors to other flights, however, as the *cc34* to *cc40* contacts of these other connectors are open.

The connectors, associated with a given flight, of all operators, have connections from their *cc34* to *cc40* contacts connected in common to the seven sector switches of that flight.

The positive battery impulses received from the booker on the operations of *bpr1* pass to the windings 1.2S, 2.3S, etc. of the sector switch magnets and each impulse advances the switch one step.

The booking operation will now be traced in relation to the example previously quoted in which three seats are to be booked on sectors 1.2 and 2.3 of a flight.

Tracing the circuit from the booker (Fig. 18); when BS reaches the eighth contact B3R (not shown, but similar to B9R) will operate. From this point B3R will remain operated over contacts *b3r1* whilst BS advances from contact 8 to contact 10, three steps, during which time BPR operates three times.

Connection 33 will remain connected to battery+ during this time and this connection will be extended (over *s3r9* front, *s2r9* back, and *s1r9* back contacts), by *bpr1* during three closures of those contacts passing 3 battery+ pulses via connection 25 and *r1.2p3*, connection 90, across Figs. 23 and 24 to Fig. 12, *cc34*, and *rs1* back to 1.2SM; and via *r2.3p3* connection 91, across Figs. 23 and 24 to Fig. 12, *cc35* and *rs2* back, to 2.3SM (not shown in Fig. 12 but similar to 1.2SM).

On BS stepping to contact 11, BZ operates via *eb2* front contacts, contact 11 and wiper BS3, *bb3* back and *eb1* front contacts. (BB being released at this moment, though it re-operates immediately afterwards.)

BZ breaks the operation circuit over N4 front contacts, connection 39 crossing Fig. 22 to Fig. 18, *bz2* back, *cz2* back and *bb2* front contacts, of BPR in the booking clerks' circuit (Fig. 10), at *bz2* (Fig. 18) and operates the clerks' BM relay (Fig. 10) via *rkb2* front, *n3* front contacts connection 38 crossing Fig. 22 to Fig. 18 *bz2* front, *cz2* back, *bb2* front contacts. Opening of *bm1* back contacts releases RKB; *rkb1* opens and releases N, *rkb3* releases SA, BM holds in the meantime over *bm1*, *sa1* *sa2* front contacts, until release of SA, and then over *bm1*, *sa2* back contacts, book key (being still operated), various springs of space keys, connections 23 and 24 bridged by *bar3* front contacts, and *sa1* back contacts so long as the book key and one space key are operated.

N, releasing, releases EB (in Fig. 18) previously operated over *n2* and connection 40, which in turn releases the B10R to B1R relays at *eb1*, which in turn releases BZ previously holding over *bz4* front, *ec2* back and *b10r3* to *b1r3* front contacts.

SA (Fig. 10) releasing, leaves the booking proceeding lamp held over *bm3* and the lamp extinguishes on release of BM. In practice this will coincide with the release of the book key, though the release of the operated space key, with the book key still operated, would have the same result.

BZ (Fig. 18), on releasing, energizes BSM over *bb1* front, *cz1* back, *bz1* back contacts and BS moves off contact 11, at the same time open circuiting BA (at BS *dm*) which releases, and, in doing so, releases BB, at *ba3*. The relays of BS driving circuit are now all at normal as drawn in Fig. 18 and BS "runs home," under self inter-

ruption over *ba*2, BS1 contacts 2 to 25 and wiper, *b*10*r*4 back contacts and BS *dm* interrupting, till it arrives at contact 1, which is disconnected on bank No. 1, when BS stops, unless an operator is waiting to book with his SA relay operated, which would start the booking sequence again immediately by successive operation of N in that operator's circuit and EB, B10R, BA, BB etc., in the booker, as before.

It should be realised that, though no two operators can use the booker to book simultaneously on the same flight since the allotter stops this (by the operation of BF relay of a flight already being booked), any number of operators can make bookings simultaneously off the same rotation of BS since this simply feeds different numbers of impulses to certain common connections. To do this however, the operators concerned must have succeeded in passing the allotter and be waiting with their SA relays operated, for BS alight on contact 1 and complete their N relay operating circuits (by bridging connections 41 and 42 on Fig. 18).

When BS reaches No. 1 contact, each operator's circuit then connects the impulses, in number according to the space he requires, to the sectors between the places whose "Airport" keys (K1–P, K2P, etc.), he has operated, of the flight to which he is connected via CC relay contacts of his connector associated with that flight. All operators can theoretically do this simultaneously provided they all book for different flights.

This completes the description of the functions performed by a booking clerk.

Controller—examining for space available

A controller's circuits will now be described and the figures should be arranged according to Fig. 20.

The procedure is identical with that followed by a booking clerk, down to and including the operation of route month and day of month keys, and the description of these operations on the part of a booking clerk is contained in the passage of the foregoing description under the heading "Booking Clerk Examining for Space Available. Route, Month and Date," which can be applied to operations by a controller with the figures arranged according to Fig. 20, by substituting references to Fig. 29 for references to Figs. 23 and 24 and substituting "Controller" for "Booking Clerk" or "Operator" where the context permits.

At this point in the procedure, the state of affairs is as follows:

The C and CC relays of the connector associated with the preferred flight of the day in question have operated (Figs. 8 and 12). The S relay in the controller's circuit will have operated, and the T relay will have released (Fig. 7).

A controller will not usually operate airport and space keys at this point as does a booking clerk according to the description under the heading "Booking Clerk, Examining for Space Available, Sector Selection and Barred Journeys" since a controller is automatically informed at this point of the state of bookings on the flight, on automatic numerical indicators, without operating such keys even though the flight unavailable lamp may light, due to the busy-free key in the flight circuit, being at "Busy."

A controller's position is fitted with a pair of indicators, one for tens and one for units digits, for every sector of the longest flight with which the installation is equipped to deal. (In this embodiment seven are provided.)

These indicators and their circuits are shown on Figs. 11 and 13, Fig. 11 showing the circuits individual to a controller's position and Fig. 13 the common indicator setting circuit.

The connections 176, 177, 178, 179, 180 and 181 passing between Figs. 11 and 13 are connected in common to corresponding points on all controllers' circuits. This is indicated by the arrows on these connections along the dotted line indicated by Greek letter theta on Fig. 13. The operation of relay S (Fig. 7), causes SD (Fig. 11), to operate over *a*5 back, *z*1 back contacts, connection 45 crossing Figs. 17, 26, 27 and 6, to Fig. 7, *zz*1 back and *s*3 front contacts. One operation, SD holds independent of *a*5, over *sd*1 front, *z*1 back contacts, connection 45, *zz*1 back and *s*3 front contacts.

Controller—common indicator setting circuit

AA relay then operates over *aa*1 back, *sd*2 front contacts, connection 180 crossing from Fig. 11 to Fig. 13, contact 1 and wiper of second bank of DS, connection 176 re-crossing to Fig. 11, and *sd*3 front contacts.

DS is a rotary switch of uniselector type and there is only one of them in the whole equipment. It has 3 banks in use, the first for "homing," the second for control, the third to actuate the tens and units dials respectively, of the "space" indicators on the controller's panels, throughout the equipment.

The driving circuit for switch DS is shown in the lower part of Fig. 13.

Continuing the sequence of events from operation of AA; ED (Fig. 13) operates over connection 181 and *aa*4 front contacts, DA operates over *ed*1 front contacts and DS *dm* closed, DB operates over *da*2 operating DSM over *db*1 front and *dz*1 back contacts. Operation of DSM steps the switch, momentarily opening the switch interrupters DS *dm* which releases relay DA.

DB is released in turn at *da*2 releasing DSM at *db*1. Reclosure of DS *dm* operates DA, and the stepping cycle for the switch DS is repeated. DS continues to step round automatically but it must be remembered that DS2 must be on No. 1 contact to start the process (by operation of AA).

When DS reaches the sixth contact, the wiper of DS2 completes the operation path for relay A on the controller's circuit (Fig. 11) over *a*6 back, *aa*2 front contacts, connection 179 crossing to Fig. 13, contact 6 and wiper of DS2, connection 176 crossing to Fig. 11, and *sd*3 front contacts. A holds over *a*6 front and *aa*3 front contacts. Relay D (Fig. 12) in the connector in use, then operates over *cc*41 front contacts connection 140, crossing Figs. 29, 28 and 17 to Fig. 11 and *a*1 front contacts. There is one D relay for every connector of every controller served by the complete equipement and they are operated over *cc*41 contacts of the respective CC relays. D contacts are provided, in pairs, for each sector of the longest flight to be connected. In this embodiment, the provision is made for seven sectors requiring 14 contacts to each D relay.

Connections 141 to 154 inclusive passing across Figs. 17, 28 and 29 from the tens and units indicators in a controller's position are connected in common to corresponding D relay contacts of all connectors serving a controller, as indicated along the dotted line marked with asterisks, on Fig. 29, whence they are extended to the

wipers of the third and fourth banks of the sector switches, (tens to the third bank, units to the fourth), of the flight with which each connector is associated. The third and fourth bank wipers of the sector switches of a given flight have similar connections in common from the connectors associated with that flight of all controllers having access thereto, as indicated along the dotted line marked with the Greek letter phi on Fig. 12.

Thus, for instance, the tens and units indicators in the "sector 1.2" position on a controller's panel are connected in common respectively to *d*1 and *d*2 contacts in all connectors serving that controller and the connections from the other sides of *d*1 and *d*2, in each connector, are connected to the wiper of the third and fourth banks respectively of the sector switch for sector 1.2 of the flight with which that connector is associated.

In the sequence of operations now being described the D relay which operated was the one in the connector associated with the preferred flight on the route and date set upon the keys in the first instance and paths are prepared for connection of all the sector indicators on the panel of the controller in question to all sector switches of that flight, respectively.

The D relays do not operate while DS is stepping from contact 1 to contact 6 (A not yet having operated) and this provides a delay deliberately arranged to insulate the indicators from any relay chatter during clearing and re-setting of indicators, on the controller advancing and regressing amongst alternative flights, as will be explained later.

From the time of the operation of relay A, Fig. 11, on arrival of DS, Fig.13, at contact 6, the operations of relay DB, cause synchronised operations of relay DPR in the controllers circuit over *a*4 front contacts, connection 177, *dz*3 back and *db*2 impulsing contacts producing impulses which continue in step with the moves of the switch DS from contact to contact, until the operation of DZ (later explained). The opening and closing of *ab*2 in the stepping cycle of DS, previously described, is responsible for the recurrent operation of DPR.

The third bank of DS has, attached to its sixth to fifteenth contacts inclusive, ten relays, one to each DS3 contact, named and numbered 0R, 9R etc. to 1R respectively, in that order. In Fig. 13, 3R to 8R inclusive are not drawn to simplify the figure, their omission being indicated by a dotted line. Their contacts and connections are similar to those of 9R.

As DS alights upon position 6, 0R operates over contact 6 and wiper of DS3, *db*3 back and *ed*2 front contacts, DB having released after the move to contact 6. 0R then holds over 0*r*1 front, *ed*2 front contacts and closes a path (via 0*r*2) from battery+ via connection 138, crossing from Fig. 13, across Figs. 11, 17, 28 and 29 to Fig. 12, to one or more contacts on the third and fourth banks of each of the sector switches of all flights, in parallel.

Any wiper standing on such a contact would then receive this battery+ potential for the period whilst the relay 0R is operated.

On DS moving to the seventh contact relay 9R operates and so on in succession down to 1R, all relays, once operated, holding over their No. 1 contacts and *ed*2.

Whilst DS is stepping from contact 6 to 15 the DPR relay of the controller concerned is impulsing in step with the moves of DS from contact to contact. On moving to contact 16, the relay DZ operates over contact 16 and wiper of DS3, *db*3 back, and *ed*2 front contacts and opens at *dz*3 the circuit supplying battery along connection 177 to the controller's impulsing relay DPR.

The relay 0R will therefore have been operated during 10 impulses of DPR and any circuit closed through its contacts and also through contacts of DPR, in series would receive 10 impulses; similarly, with 9R, 9 impulses, and so on.

These conditions are fulfilled by the DPR contacts in the controllers' indicator circuits, the number of impulses being governed by the particular contact upon which the sector switch is standing at the time, the indicator circuits being traced via contacts *dpr*1–14, connections 141 to 154 inclusive, which cross Figs. 17, 28 and 29, from Fig. 11 to Fig. 12, where they terminate on contacts *d*1 to *d*14 respectively, in that order, and thence via wipers and contacts of the 3rd and 4th banks of the 7 sector switches, (odd numbered *d* contacts to the third banks, even numbered *d* contacts to the 4th banks) along one or other of the connections 129 to 138 inclusive according to the positions sector switch wipers, across Figs. 29, 28, 17 and 11, to Fig. 13, via No. 2 contacts of one of the ten relays 0R to 1R, to battery+.

The "tens" indicators are thus connected, via DPR and D relay contacts to the third bank of the sector switches and the "units" indicators to the fourth bank and the contacts of these banks are connected to battery+ via contacts of the 0R–1R relays according to the difference between the number of hooked seats represented by each contact, and the total number of seats on the aircraft involved in the flight.

To simplify the tracing of these connections, the connections 129 to 138 are marked at each end with a number corresponding to the number of DPR impulses during which their battery+ circuits are closed, and the connections leading from the contacts of the 3rd and 4th banks of the sample sector switch 1.2S illustrated in Fig. 12 are correspondingly marked and indicate the respective prefix numbers of the relay contacts 0*r*2, 9*r*2, etc., to which the switch contacts are connected. Inside the circle of contacts on the switch banks are figures indicating the serial numbers of the contacts in the direction of rotation of the switch wipers.

Suppose the aircraft concerned has 24 seats; the maximum number with which this particular type of switch will deal.

When one seat has been booked, the booking part of the equipment will have caused the switch in question to advance to its No. 2 contact, (No. 1 contact being used as a home position). There will be 23 seats remaining. The contacts 1 to 5 inclusive of the third bank of the sector switch will be connected to battery+ via connection 130 and contacts of relay 2R while contacts 1, 2, 3, 4, 5 of the fourth bank, will be connected to battery+ via connections 132, 131, 130, 129 and 138 and contacts of relay 4R, 3R, 2R, 1R and 0R respectively in that order. When DS advances to contact No. 6 and starts the impulse relay DPR to impulse and the relays 0R to 1R to operate in succession, 2R relay being second from the end of the chain, will remain operated during 2 steps of the switch DS and consequently during two operations of DPR. The tens indicator of the panel of the controller connected to a sector switch standing on contact 2 will be connected to battery+ during this time over a pair of *dpr*

contacts and *d* contacts, wiper and contact No. 2 on No. 3 bank of corresponding sector switch and 2*r*2. As explained above, DPR will operate twice during this time and will move this indicator two places to indicate figure "2." Similarly, No. 2 contact on the fourth bank of the sector switch is connected via connection 131 and contacts of relay 3R, to battery+ and the impulse relay DPR operates 3 times whilst 3R is operated. The controllers units indicator will therefore move to figure "3."

All sector switches of all flights will have a battery+ connection applied to all their contacts in turn during a time during which the appropriate number of impulses of DPR have taken place and the position in which their third and fourth bank wipers are standing corresponding to the tens and units digits of the space remaining, will be indicated by numbers of impulses connected to the bank contacts on which the wipers are standing.

This information can only be conveyed to the panel of a controller whose D relay is operated. D relays are operated when AA relays operate (as a result of DS arriving at contact No. 1, which is its normal position of rest) followed by operation of A relays (on DS1 reaching contact No. 6). Without these relays operated, a controller's DPR relay has its operating path open circuited (at contacts *a*4).

If several controllers finished keying up a route and date simultaneously, DS switch being at rest, they would all operate the necessary relays to connect their indicators to the sector switches of the flights in which they were interested and those indicators would show the space available on all sectors of the flight set up on the keys. This would apply whether the controllers were interested in the same, or different flights, since the DS switch and 0R to 1R relays scan all sector switches in the complete equipment simultaneously. If the DS switch were to be in the middle of a cycle when a controller finished setting up his route and date, he would get no result for the moment, and would have to wait till the cycle of DS was finished and it returned to No. 1 contact. Any number of controllers waiting thus, would all commence to receive information at the same time.

It will thus be seen that, despite the fact that there is only one DS switch for the whole equipment, no controller will be kept waiting longer than one rotation of DS.

The indicators used are of a type having two windings, one of which, when energised, operates an impulsing or setting solenoid, the other of which, when energised, holds the dial or rotor in the position reached.

The DPR relay contacts in the drive circuits of the indicators, shown in Fig. 11 are arranged so that when the relay is operated, the battery connection from the sector switch is applied to the impulse winding and when the relay is released this connection is applied to the holding winding. The removal of battery altogether, allows the indicator to fall back to zero under the action of a spring. This would happen on the DS switch reaching contact 16 (and releasing the 0R to 1R relays after a sequence to be described), but for the fact that relay Z in the controller's circuit, (Fig. 11), operates, over *a*3 front contacts, connection 178 *dz*3 front and *db*2 front contacts and applied a local battery (through a resistance) to the holding windings of all indicators. (These connections are made by 14 *z* contacts numbered *z*3 to *z*16, shown in Fig. 11).

When DS reaches contact 16 and DS *dm* contacts close, DA and DB relays operate in succession as previously, (it is at this point that relay Z operates, DZ being operated to close *dz*3 contacts). Z holds over *z*1 front contacts, connection 45 crossing Figs. 26, 27 and 6 to Fig. 7 *zz*1 back and *s*3 front contacts. Relay SD, (Fig. 11), releases (open circuited at *z*1 back contacts), AA releases (now open circuited at *sd*2 and *sd*4), A releases, its holding circuit being disconnected at *aa*3. D releases, its operating path over *cc*41 connection 140 and *a*1 being open circuited at *a*1, which, incidentally, prepares the way for investigating another flight. ED also releases, its holding circuit over connection 181, being broken at *a*2 contacts, relays 0R to 1R release, their holding circuits being broken at *ed*2.

DZ releases, its holding circuits being broken at 0*r*3 to 1*r*3. The release of relay ED, which has remained continuously operated since the commencement of DS scanning cycle, causes DS to "run home" over *da*3 back contacts, DS bank No. 1, wiper and contacts, of which numbers 2 to 25 are interconnected, *ed*1 back contacts and DS *dm* intermittently. On reaching contact 1 which is disconnected on this bank, the switch DS stops, ready for another call, or else, if a call is waiting, it repeats the cycle by operating the AA relay of some controller over *aa*1 back, *sd*2 front contacts, connection 180 contact No. 1 and wiper on the 2nd bank of DS, connection 176 and *sd*3 front contacts, the SD relay of a controller being operated when he is waiting with an enquiry.

During the "run home" of DS, the DA and DB relays are released at the first break of DS *dm* (DA at DS *dm* and *da*1, DB at *da*2) and remain so till the start of a new cycle.

It should be noted that the relay 0R is used to drive the indicators to figure "0," and it will also be seen that the indicators to be driven to the highest numbers will start stepping first and all will finish together.

After the indicator setting operation, and when DS has stepped to contact 16, relay Z remains operated and would normally be released on restoring the route, month and date keys or any one of them, which would release relay S Fig. 7, by removing the battery+ marking condition on the contact on the 2nd bank of route switch R1S on which this switch was standing.

Controller—examining for space available, searching different flights

When a controller is unable to find the required space in the preferred flight for the route and date set up on his keys, he operates his ADK, or RGK keys which sets up a hunting action along his connector circuits for the flights on that route and date, in the manner previously described under the heading "Booking Clerks, Examining for Space Available, Searching Different Flights." There are, however, extra sets of springs (ADK1 and 2, RGK1 and 2) on a controller's advance and regress keys which are omitted from, or left disconnected at connection 43 in the case of the booking clerk's keys.

On operation of ADK or RGK relay ZZ is operated over RGK1 or ADK1 as the case may be. ZZ, at *zz*1, breaks the holding circuit over connection 45, of relay Z breaking in turn the holding circuit of all the indicators (at contacts *z*3, *z*4, etc.) permitting the indicators to reset to nil indication under the action of their return

springs. On release of ADK or RGK (as the case may be), the C relay of another connector circuit operates. It will be remembered that the ADK or RGK keys must be operated once and released to complete a step of advance or regression. Relay S (Fig. 7) remains operated (as the *c*5 contacts of the C relays of all connectors serving an operator, are connected in common to his S relay and at least one C relay is operated at all times during "advancing" and "regressing"), and the release of ZZ at RGK1 or ADK1 as the case may be, when the operated key is released, provides an operating path for SD relay (Fig. 11), over *a*5 back, *z*1 back contacts, connection 45 crossing Figs. 26, 27 and 6 to Fig. 7 *zz*1 back and *s*3 front contacts, and the scanning cycle of DS recommences (if DS is at rest, immediately, if in use, when it returns to its contact No. 1).

A controller will frequently require to examine the state of bookings on flights in his province for supervision purposes without any intention of booking seats but if he does want to make a booking, he will have to operate airport keys in the same manner as does a booking clerk, which will operate RKP, relays R1.2P, R2.3P etc. for the sectors of the journey, and BAR provided that not all sectors are barred in the same way as previously described under the heading "Booking Clerks, Examining for Space Avaliable, Sector Selection and Space Available," down to the operation of relay BAR. Failure of BAR to operate, would cause the journey barred lamp to light (Fig. 9), over *bar*1 back *rkp*8 front contacts but would not prevent a booking being made. The difference in this respect can be seen by comparing Figs. 10 and 17, where it will be observed that the booking clerks access to the allotter, via connections 4 and 5 is broken by *avr*2 and *avr*3 contacts which are only closed on operation of AVR (Fig. 10) whereas the corresponding connections 1 and 2 are not so broken in the case of a controller's circuit and he has no AVR relay.

Controller—booking

The space keys on a controller's position are not required in connection with "Space Available" examination and are concerned only with the determination of the number of seats to be booked, or cancelled. The keys are shown in Fig. 17 and each has two pairs of contacts which close on operation of the key. The number 1 contacts are operative when booking, the number 2 contact when cancelling. In practice panel space can be saved by using five two-way keys, the upward positions being used for booking or cancelling from 1 to 5 seats and the lower, from 6 to 10 seats. Five two-way keys are shown in the panel lay-out in Fig. 5, but it simplifies the description to treat them as ten one-way keys, and they are drawn that way in Fig. 17, intermediate keys, S3K to S8K being omitted to simplify the drawing.

The connections of the contact bearing members of the keys are, in the case of the Number 1 contacts, (concerned with booking), to terminals 1 to 10, the number of the key being the same as the number of the terminal, and, in the case of the Number 2 contacts (concerned with cancellation) to the terminals in the reverse order, those of S1K going to terminal 10, and those of S10K going to terminal 1 and so on for the other keys.

The connections from the blades of the space keys, already traced through contacts of relays RBK and RCK respectively and thereafter through contacts of relay BPR pass over connection 175 crossing Figs. 26 and 27 to Fig. 9 where the connection is distributed via the No. 3 contacts of the sector relays R1.2P, R2.3P etc. to R7.8P, amongst connections 90 to 96 which cross Fig. 29 to Fig. 12 and, passing through CC relay contacts *cc*34 to 40, of the connector in use terminate upon the various sector switches of the flight to be booked. The previous operation of the airport keys K1P, K2P etc. sets the sector relays R1.2P, R2.3P etc. so as to connect only the required sectors and the connector passes the connections in the required flight. Connections 90 to 96 as indicated, by the arrows on the connections, along the dotted line marked with asterisks on Fig. 29, are connected in common to similar points on all connectors, serving a given operator, associated with the flights to which he has access.

Having operated the appropriate space keys, the "Book" key (Fig. 17) is now operated which operates RBK, over book key *rck*1 back, *rbk*1 back, *bm*1 back contacts, connection 173, crossing Figs. 26 and 27 to Fig. 9, *rkp*9 front contacts, connection 174 crossing Figs. 27, 26 and 17 to Fig. 11, *z*2 front contacts; relay Z in the controller's indicator circuit (Fig. 11), being operated, over *z*1 front contacts, (Fig. 11) connection 45, crossing Figs. 17, 26, 27 and 6 to Fig. 7, *zz*1 back and *s*3 front contacts. It will be remembered that RKP (Fig. 9) was operated on operation of the airport keys. RBK holds on operation over *rbk*1 front, *bm*1 back contacts, connection 173, crossing Figs. 26 and 27 to Fig. 9, *rkp*9 front contacts, connection 174 crossing Figs. 27, 26 and 17 to Fig. 11 *z*2 front contacts. RBC now operates over *rbk*2 front contacts, which connect battery+ to connection 174 and thus confirm the holding circuit of RBK at *rbc*1 front contacts in parallel with *z*2 front contacts irrespective of the operation or release of Z. RBF now operates, over *rbc*2. RBF can also be operated before commencing booking, by operation of the seize key, over connection 44 crossing Figs. 26, 27 and 6 to Fig. 7 the seize key and *s*4 (S being operated when a connector is taken into use) where the controller wishes to prevent booking for a time whilst the situation is investigated.

RBF operates CAL (Fig. 14) in the allotter over *tal*2 back contacts, connection 2 crossing Figs. 27 and 26 to Fig. 17, *rbf*2 front contacts, connection 128 crossing Figs. 28 and 29 to Fig. 12, *cc*29 front and *bf*1 back contacts (unless the allotter is busy in which case TAL would be operated breaking the CAL operating circuit at *tal*2). CAL, operating, transfers TAL connection from the 1st bank of SAL, to the second bank at *cal*2, thus preventing SAL from hunting for a booking clerk's contact, putting a holding connection on CAL at *cal*3 in parallel with *tal*2 and connecting the self drive circuit for SAL over SAL *dm*, *tal*1 back, *cal*1 front contacts, connection 2 crossing Figs. 27 and 26 to Fig. 17, *rbf*2 front, contacts, connection 128 crossing Figs. 28 and 29 to Fig. 12, *cc*29 front contacts and *bf*1 back contacts. SAL then hunts for the marked contact on bank 2 which receives a battery+ connection, via connection 1 crossing Figs. 27 and 26 to Fig. 17, *rbf*3 front, contacts, connection 127 crossing Figs. 28 and 29 to Fig. 12, *cc*30 front, and *bf*2 back contacts. On reaching the marked contact, this battery+ connection is applied to relay TAL (via *cal*2 front contacts and 2nd bank wiper of SAL). TAL operates and trips the drive of SAL at *tal*1 and in turn oper-

ates SA, over connection 3, crossing Figs. 26 and 27 to Fig. 14, 3rd bank and wiper of SAL (SAL3), *tal*1 front, *cal*1 front contacts, connection 2 crossing Figs. 27 and 26 to Fig. 17, *rbf*2 front contacts, connection 128 crossing Figs. 28 and 29 to Fig. 12 *cc*29 front and *bf*1 back contacts and SA holds over *sa*5 and *rbf*1 front contacts.

SA operating, operates BF, over *cc*31 front contacts, connection 126 crossing Figs. 29 and 28 to Fig. 17 and *sa*6 front contacts, which locks the flight against intrusion by completing the booker busy lamp or booking proceeding lamp circuits over *sa*7 front or back contacts respectively, connection 125 crossing in the case of a booking clerk from Fig. 10, via Fig. 24 to Fig. 12 and in the case of a controller from Fig. 17, via Figs. 28 and 29 to Fig. 12, *cc*32 front and *bf*3 front contacts, of any other operator examining the flight. BF also operates ZZ relay, (Fig. 7), over RGK2, ADK2, connection 43 crossing Figs. 6, 27, 26 to Fig. 17, and thence over connection 139 crossing Figs. 28 and 29 to Fig. 12, *cc*33 front, and *bf*4 front contacts. It will be remembered that ADK1 and 2 and RGK1 and 2 appear only in a controller's circuit. The process so far can be started either by depressing the seize key or the book key. In the former case however, though all the booker busy symptoms are apparent to other operators, the controller cannot book.

Contacts *zz*1 release relay Z in the controller's indicator setting circuit previously held over, *s*3 front, *zz*1 back contacts, connection 45 crossing Figs. 6, 27, 26 and 17 and *z*1 front contacts, and his indicators re-set. Contacts *z*2 also open the original operating circuit of RBK, but these contacts are now bridged by *rbc*1 and RBK holds.

CAL (Fig. 14) also releases its operating circuit over *cal*3 front contacts, connection 2, crossing Figs. 27 and 26 to Fig. 17, *rbf*2 front contacts, connection 128 crossing Figs. 28 and 29 to Fig. 12 *cc*29 front and *bf*1 back contacts, being open circuited at *bf*1 and the allotter is free to search for other operators wishing to book.

N relay in the controller's circuit (Fig. 17) now operates over *n*1 back, *rbc*3 front, *sa*3 front contacts, connection 41 crossing Fig. 26 to Fig. 18, BS2 wiper and contact No. 1 (provided that BS is standing on contact No. 1), connection 42 crossing Fig. 26 to Fig. 17, *sa*4 front and *bm*2 back contacts and N holds, over *n*1 front and *rbf*4 front contacts.

EB (Fig. 18) operates, connection 40 crossing Fig. 26 to Fig. 17, *rkb*3 front and *n*2 front contacts and the BS cycle commences in the same manner as previously described in the case of a booking clerk, except that the battery potentials on connections 26 to 35, and on the numbered terminals to which they are connected on Fig. 26 are fed to contacts *bpr*1 of the impulse relay BPR, through springs of the controllers' space keys directly and not indirectly through relay contacts as in the case of a booking clerk. Comparison of Figs. 17 and 10 shows this difference. Contacts *rbk*5 intervene to complete this circuit when a booking is being made. BZ (Fig. 18) operates when the ten impulses are complete which operates BM (Fig. 17), over *n*3 front, *rbk*4 front contacts, connection 38 crossing Fig. 26 to Fig. 18, *bz*2 front, *cz*2 back and *bb*2 front contacts.

BM releases RBK previously held over *rbk*1 front, *bm*1 back contacts, connection 173 crossing Figs. 26 and 27 to Fig. 9, *rkp*9 front contacts, connection 174 crossing Figs. 27 and 26 to Fig. 17, and *rbc*1 front contacts, at *bm*1, RBC is released at *rbk*2, RBF is released at *rbc*2, and N is released at *rbf*4. RPB is also disconnected at *bz*2 in Fig. 18, when BZ operates, on BS moving to contact No. 11. Booking is now complete and SA releases being open circuited at *rbf*1 and BF in the flight circuit concerned releases, its operating circuit over *cc*31 (Fig. 12) connection 126 crossing Figs. 29 and 28 to Fig. 17, and *sa*6 front contacts being open circuited at *sa*6. ZZ (Fig. 7) now releases, its operating circuit over RGK2, ADK2, connection 43 crossing Figs. 6, 27 and 26 to Fig. 17 being open-circuited at *bf*4.

Operation of ZZ permits SD in the controller's indicator setting circuit (Fig. 11) to operate over *a*5 back *z*1 back contacts, connection 45 crossing Figs. 17, 26, 27 and 6 to Fig. 7, *zz*1 back and *s*3 front contacts, and the indicator setting cycle commences, setting the controller's indicators to show the new "Space Available" condition of the flight and confirm the correctness of the booking.

Controller—cancelling bookings

To cancel a booking, the process is identical except that the "cancel" key (Fig. 17) is used instead of the "Book" key, RCK operates instead of BBK, over cancel key, *rck*1 back, *rbk*1 back contacts (in parallel) *bm*1 back contacts, connections 173 and 174 crossing Figs. 26 and 27 to Fig. 9 where they are bridged by *rkp*9 front contacts, and along connection 174 to Fig. 11, and *z*2 front contacts, EC operates instead of EB, (over connection 36 crossing Fig. 26, from Fig. 18 to Fig. 17, *rck*3 front, and *n*2 front contacts) and the switch BS does not operate BZ on reaching contact 11, it being open circuited at *eb*2, but goes on, still connected at *b*1*r*2, *b*2*r*2 etc., to connections 26 to 35 and the numbered terminals, on Fig. 26, for 14 more impulses whilst passing from contacts 11 to 24 inclusive, until, on reaching contact 25, CZ operates over contact 25 and wiper of BS3, *bb*3 back, *ec*1 front contacts, to cut out at *cz*2 the impulse relay BPR previously impulsing over *n*4 front contacts, connection 39 crossing Fig. 26 to Fig. 18, *bz*2 back and *cz*2 back and *bb*2 front contacts. No impulse is made on this 25th contact. Owing to the manner of connection of the No. 2 blades of the space keys, (the right hand blades in Fig. 17), which communicate with the contacts *rck*5 of the cancel relay RCK, instead of *rbk*5 of the book relay RBK, and of the corresponding No. 2 contacts of these keys, a cancellation of 10 seats connects the impulsing circuit to terminal 1, (9 seats terminal 2; 8 seats, terminal 3, and so on). A cancellation of say—9 seats is therefore effected by connecting the flight circuit via the impulse relay to No. 2 terminal on the booker which connects battery—during the normal time of 2 impulses during which *b*2*r*2 contacts are closed. Instead, however, of opening *b*2*r*2 contacts on BS reaching contact 11, as in booking, the relay remains operated for the space of a further 14 impulses of BPR and consequently the sector switches in question make 16 steps. These switches have 25 positions of which 24 represent the bookings of seats. The No. 1 contact as previously explained, being the rest position of the switch, indicates that the flight is unbooked.

To cancel a number of seats, therefore, is the same thing as booking 25 minus the number to be cancelled, which so fas as cancellations up to 10 are concerned is the same as booking the complement to 11 of the number to be cancelled, plus 14; e. g. 25—9=11—9+14=16.

The said complement arises from the fact that

the blades of the No. 2 contacts of the space keys produce, during the travel of BS to contact 10, impulses being the complement to 11 of the number of the key operated (e. g. STK² blade is connected to terminal 4).

The "fourteen" represents the extra 14 impulses delivered during the travel of BS over contacts 11 to 24 inclusive (no impulse occurring on the step to contact 25). Cancellations of 1 to 10 seats will therefore be equivalent to booking 24 to 15, respectively, the switch going past the 25th contact and commencing a new rotation. Since contact 1 is used as standing position representing an empty flight, a booking of, say —10 seats, will place the switch on contact 11. To cancel 9, as in the example, so as to leave one seat showing as booked, will therefore be effected by (in effect) booking 2 plus the 14 additional impulses added by the booker whilst BS covers contacts 11 to 24 inclusive, contact 25 giving no impulse. The sector switches will therefore advance from contact 11 to 25, which means 14 steps, and then two more of a new circuit. This will place the sector switch on the second contact, leaving one space booked, which is as desired.

If an aircraft has less than 24 seats, the controller, when setting up flights, will book seats on this aircraft sufficient to leave available only the number of seats on the aircraft. This pseudo-booking will reduce the remaining seats available, to the correct number, for all space indicating functions of the apparatus and will give correct results in both booking and cancelling transactions. If aircraft with more than 24 seats are to be used a larger switch may be used for the sector switches or two or more switches may be used in tandem, the changeover being effected by well known means. Any reductions of space necessitated, on these larger switches being used, can be effected by pseudo booking by the controller. A booking clerk could also effect pseudo bookings, four at a time, but this will not normally be permitted.

A controller can cancel all bookings and pseudo-bookings by operating a "Reset" key, in the flight circuit, shown in the lower half of Fig. 12.

Either a single common reset key can control a relay RS to reset all sector switches of a flight circuit, or a separate key can be provided for each sector. The "Reset" key either through RS, or directly through key contacts, closes a self drive circuit for the sector switches of the flight concerned. To refer to the sector switch 1.2S illustrated in Fig. 12, this self drive circuit is made through 1.2SM, 1.2SDM, *rs1*, (or key contacts) contacts 2 to 25 (which are strapped) of 1.2S1, wiper 1.2S1 and the switch "drives home" under self interruption at 1.2S*dm*, till it reaches No. 1 contact which is disconnected. All the sector switches behave similarly.

When a flight is fully booked or when the plane has commenced its journey, to save possible error, the controller will usually put the "Busy-Free" key to busy, for the flight in question, which will show "Flight Unavailable" to operators inadvertently keying that flight or "Advancing" or "Regressing" on to it when searching for available space.

Setting up the flight registers

After the departure of an aircraft and after checking and recording the information contained in the registers, it will not normally be necessary to retain the registers in their settings, though it may be feasible in certain circumstances to continue to accept bookings at the central office, for later stages of a flight, after the aeroplane has commenced the flight. In the latter case, the flight registers will not be cleared until it is too late to accept such bookings, though, in practice it will almost invariably be necessary to confine these transactions to the controllers.

In any event, the information in the registers will have been recorded some time soon after the completion of the journey, at the latest and the flight sector switches can then be restored to zero by use of the "Reset" key as aforesaid.

Any flight circuit is allotted to one or other of the months of the booking period since it is wired up to connectors, which are in turn connected together in groups representing the flights in a day, and one connector of each such group is wired to a bank of the operators' route switches concerned with a particular one of the months of the booking period. Furthermore this connector and indirectly the others of its group, are allotted to a definite day of the month, owing to being wired to a definite contact of a route switch bank. This must be borne in mind when a controller "sets up" a flight on a free flight circuit.

So that bookings may be accepted for a period which is always 3 months in advance of the booking date, cleared flight circuits must constantly be re-set for flights three months ahead.

Month indication—a modification

There is a possibility that an operator may inadvertently endeavor to book seats on a flight which has departed, when the flight circuit previously serving that flight has been speedily cleared and re-set to a new flight three months ahead. On operating keys for the departed flight, the operator would receive the same indications as if the plane had not departed, though the emptiness of the plane might provide a warning. This confustion is caused by the fact that only one signal lamp lights on a panel containing one month key and four alternative month names.

It may be necessary to guard against this possibility, and a modification of the circuit for this purpose, is illustrated in Fig. 16.

Here, grouped with one month key, on an operator's panel, are four lamps, each associated with one of the alternative months to which that key can refer. These lamps are connected in common to battery negative on one side and the other side of each lamp is taken through additional connections 168 to additional C relay contacts in the connectors associated with flights earmarked for the particular month of the booking period to which the month key with which they are grouped, relates. These connections will be taken in common from each of the four lamps on an operator's panel to a number of his connectors, being those associated with flights for a given month, which will be roughly a third of all the connectors serving that operator. The other connectors will similarly receive connections from the other two groups of four lamps according to the month for which their associated flight circuits are earmarked.

From all connectors associated with a flight circuit each of these four lamp connections will be taken in common to that flight circuit where each will pass to battery—via a normally open jack. A first month flight circuit will have these jacks marked "Jan," "Apl," "Jul," "Oct," a second month flight circuit, "Feb," "May," "Aug,"

"Nov," and a third month flight circuit, "Mar," "Jun," "Sept," "Dec."

When a new flight is set up by a controller, he will remove a plug from the month jack in which it was previously and replace it in the next jack.

When an operator is connected to a flight, having operated route, month and date keys, a lamp will light opposite a definite month of the twelve (and not just any one of four months), according to the month jack plugged in the flight circuit.

Searching the flights—a modification

By simple modification of the circuit, the further facility may be added, of permitting an operator to search by use of the advance and regress key, for the first flight with free space, from the date first set up on the keys, until the end of the month.

This is achieved by connecting all the connectors associated with the flights on a given route, for a month of the booking period, continuously together in order according to their times of departure and dates, in the same manner as are the connectors in Fig. 15 the connection from route switch to preferred flight in each day remaining unaltered.

When all the flights of a given date have been tried in turn and the advance or regress key as the case may be, is next operated, the C relay of a flight on the next date will operate, and a different set of date lamps will light as the connectors of this new date have their *c*8 and *c*9 contacts connected to different date tens and date units lamps.

It is not considered advisable to provide for the continuation of this interconnection beyond the end of the month, owing to the system of resetting the flight circuits when a month is past.

Conclusion

Though a single specialised embodiment has been shown it will be evident that the invention is capable of application to other uses and an alternative embodiment has in fact been developed where a route and the space required is keyed and the equipment hunts automatically for the first flight having that accommodation. It is possible to combine the features of these two embodiments to deal with more complicated booking problems such as theatre seats, for instance, the date and price being keyed and the equipment hunting automatically row by row for the first free seats.

The invention is not necessarily confined to booking systems however.

We claim:

1. In a reservation system comprising a plurality of recording means, each associated with a different unit for which a reservation may be booked, each of said recording means having a plurality of different settings, each setting representative of each reservation that may be accommodated by the unit with which each of said recording means is associated, a plurality of enquiry stations each adapted to transmit enquiry signals, a plurality of connecting means selectively coupling said stations with said recording means, said connecting means operable in response to the receipt of signals transmitted thereover from said stations, indicating means under control of said connecting means at each of said stations to indicate the setting of a selected of said recording means, and means at each of said stations to alternatively connect said stations with different, pre-selected of said recording means to indicate the setting thereof, said last-named means under control of said connecting means and said stations and operable only when a predetermined setting of a selected recording means is indicated by the indicating means associated with said enquiry stations.

2. A reservation system as claimed in claim 1, wherein said indicating means are visual indicating means.

3. A reservation system as claimed in claim 1 including means under control of one of the enquiry stations for barring enquiry of a predetermined recording means by another of said stations.

4. A reservation system as claimed in claim 1 including means for limiting to a predetermined maximum the number of alternative connections from one recording means to another by said stations.

5. A reservation system as claimed in claim 1, in which said recording means are arranged in predetermined groups and the connecting means can connect only the recording means of one group at a time to an enquiry station, and in which said altering means may be simultaneously seized by a plurality of enquiry stations for altering the setting of recording means in different groups.

6. A reservation system as claimed in claim 5, in which the said altering means includes means for producing a sequence of pulses and each enquiry station includes means for directing a selectable number of pulses to the recording means to which it is connected for operating said recording means.

7. A reservation system as claimed in claim 6, in which means is provided for holding up the seizure by an enquiry station of said altering means until said altering means has returned to its normal condition, whereby a plurality of enquiry positions attempting to seize said controlling apparatus while it is in use will all seize it at the same time at the end of its use cycle, so as to utilize the entire sequence of pulses for controlling the recording means.

8. In a reservation system as claimed in claim 1, further comprising means for altering the setting of selected of said recording means, said last-named means under control of said enquiry stations.

9. A reservation system as claimed in claim 8, wherein said enquiry stations comprise supervisory stations and booking stations and means for linking a supervisory station with a particular group of booking stations and recording means with which said group of booking stations have access.

10. A reservation system as defined in claim 9, including means individual to a supervisory station alone for obtaining exclusive connection to a recording means for enquiry purposes.

11. A reservation system as claimed in claim 1, including means at an enquiry station under control of said connecting means and said enquiry station for transferring an enquiry connection from a first of one of said recording means in a predetermined group to a second one of said recording means in said group, said transfer means operable only upon the attainment of a predetermined setting of said first recording means.

12. A reservation system as claimed in claim

11, wherein said transfer means operates to transfer an enquiry connection from a first one of said recording means in a predetermined group to a plurality of other of said recording means in the same group in a predetermined sequence.

13. A reservation system as claimed in claim 12, including means for limiting the number of such successive transfers to a predetermined maximum.

14. In a reservation system comprising a plurality of recording means, each associated with a different unit for which a reservation may be booked, each of said recording means having a plurality of different settings, each setting representative of each reservation that may be accommodated by the unit with which each of said recording means is associated, a plurality of enquiry stations each adapted to transmit enquiry signals, a plurality of connecting means selectively coupling said stations with said recording means, said connecting means operable in response to the receipt of signals transmitted thereover from said stations, indicating means under control of said connecting means at each of said stations to indicate the setting of a selected of said recording means, means at each of said stations for transferring an enquiry connection from one recording means in a predetermined group to another in said group, said transfer means operable only upon the attainment of a predetermined setting of said one recording means, said transfer means adapted to operate to transfer an enquiry connection from said one station to a plurality of other of said recording means in a predetermined sequence, and visual indicating means for automatically signalling to said enquiry station the transfer of an enquiry connection from said one recording means to another, said indicating means under control of said transfer means and said other recording means.

15. In a reservation system comprising a plurality of recording means, each associated with a different unit for which a reservation may be booked, each of said recording means having a plurality of different settings, each setting representative of each reservation that may be accommodated by the unit with which each of said recording means is associated, a plurality of enquiry stations each adapted to transmit enquiry signals, a plurality of connecting means selectively coupling said stations with said recording means, said connecting means operable in response to the receipt of signals transmitted thereover from said station, means for altering the setting of selected of said recording means, said last-named means under control of said enquiry stations, means at selected of said enquiry stations for pre-setting said recording means thereby to limit the power of other of said enquiry stations to alter said recording means, means at each of said stations for transferring an enquiry connection from one recording means to another, said transfer means operable only upon the attainment of a predetermined setting of said one recording means, said transfer means

adapted to operate to transfer an enquiry connection from said one station to a plurality of other of said recording means in a predetermined sequence, and visual indicating means for automatically signalling to said enquiring station, the transfer of an enquiry connection from said one recording means to another, said indicating means under control of said transfer means and said other recording means.

16. A reservation system as claimed in claim 15, wherein said altering means comprises a single allotter circuit, said allotter coupled to all of said stations and adapted to connect different of said stations to different of said recording means, said allotter circuit controllable by the signals transmitted by any of the stations connected thereto, and a single setting circuit coupled to all of said stations whereby different of said stations may alter the setting of different recording means during a single operation of said setting circuit.

17. A reservation system as claimed in claim 15, wherein said transfer means is adapted to successively connect an enquiry station with predetermined different of said recording means only when each of said recording means shall have attained a predetermined setting, said indicating means adapted to indicate the identity and the setting of each of the recording means to which an enquiry station is transferred.

18. A reservation system as claimed in claim 15 comprising further means at selected of said stations and under control of said stations for cancelling the setting of any of said recording means to a predetermined different setting whereby a previous setting of said recording means made under control of other of said stations is nullified, said further means adapted to transmit signals from said selected stations to said recording means over said connecting means, each signal representative of the number of settings by which said recording means is to be altered.

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