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Walton

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[54] **ELEVATOR CONTROLS FOR SYSTEMS HAVING WIDELY SPACED LANDINGS**

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[52] **U.S. Cl.** ..... **187/29 R**
[51] **Int. Cl.** **B66b 1/22**
[58] **Field of Search** 187/29

[56] **References Cited**

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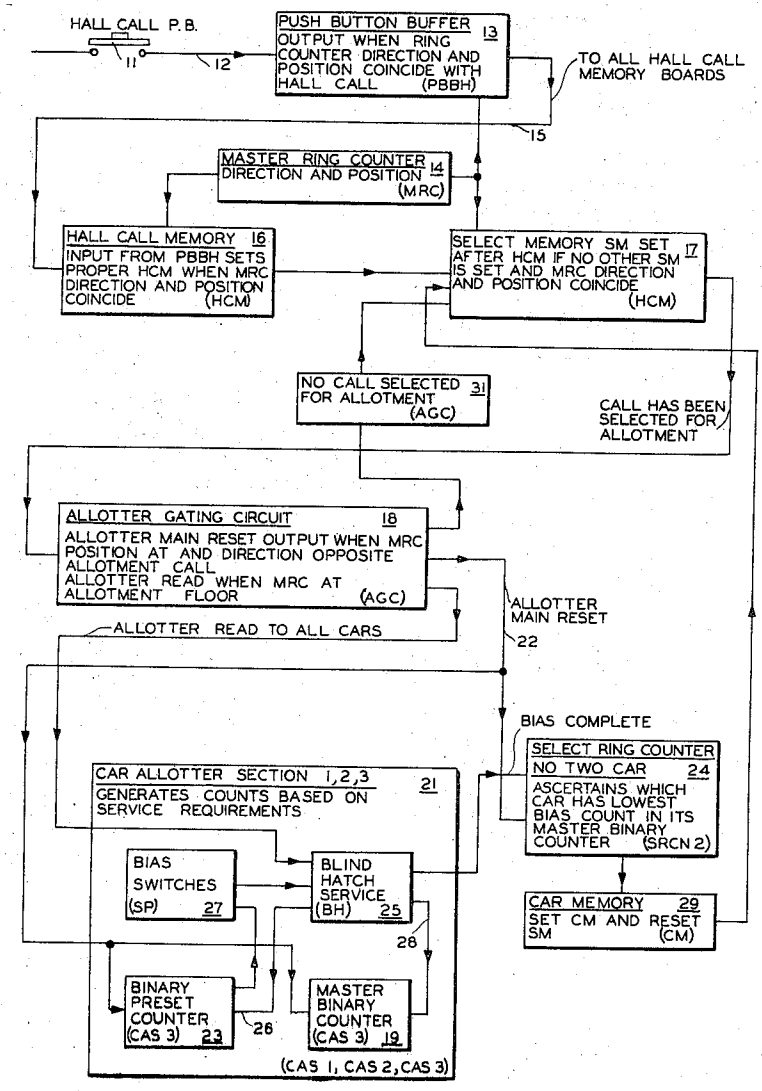
3,425,515	2/1969	McDonald et al.	187/29
3,610,370	10/1971	Suozzo et al.	187/29

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Assistant Examiner—W. E. Duncanson, Jr.
Attorney, Agent, or Firm—David H. Wilson

[57] **ABSTRACT**

An elevator system for controlling cars on the basis of their separation from a destination, particularly for assigning hall calls to individual cars on this basis. The presence of an abnormally long spacing between a car and a destination, such as a hall call to be assigned, is sensed and a signal generated to represent that spacing. Landing count can be employed for normal spacing and a characteristic signal is utilized for the long spacing as encountered with a blind hatch region. A fixed pulse count is developed for each of the relatively uniform spaced landings and a proportionally longer pulse count is employed for the long travel increment of a blind hatch traverse. The blind hatch service factor is represented by a predetermined number of pulses which are accumulated on a per car basis in a master counter with other pulse series representing various service factors. The total counts for the cars are then compared and the hall call is assigned to the car with the lowest count as being best suited to serve the call.

15 Claims, 4 Drawing Figures



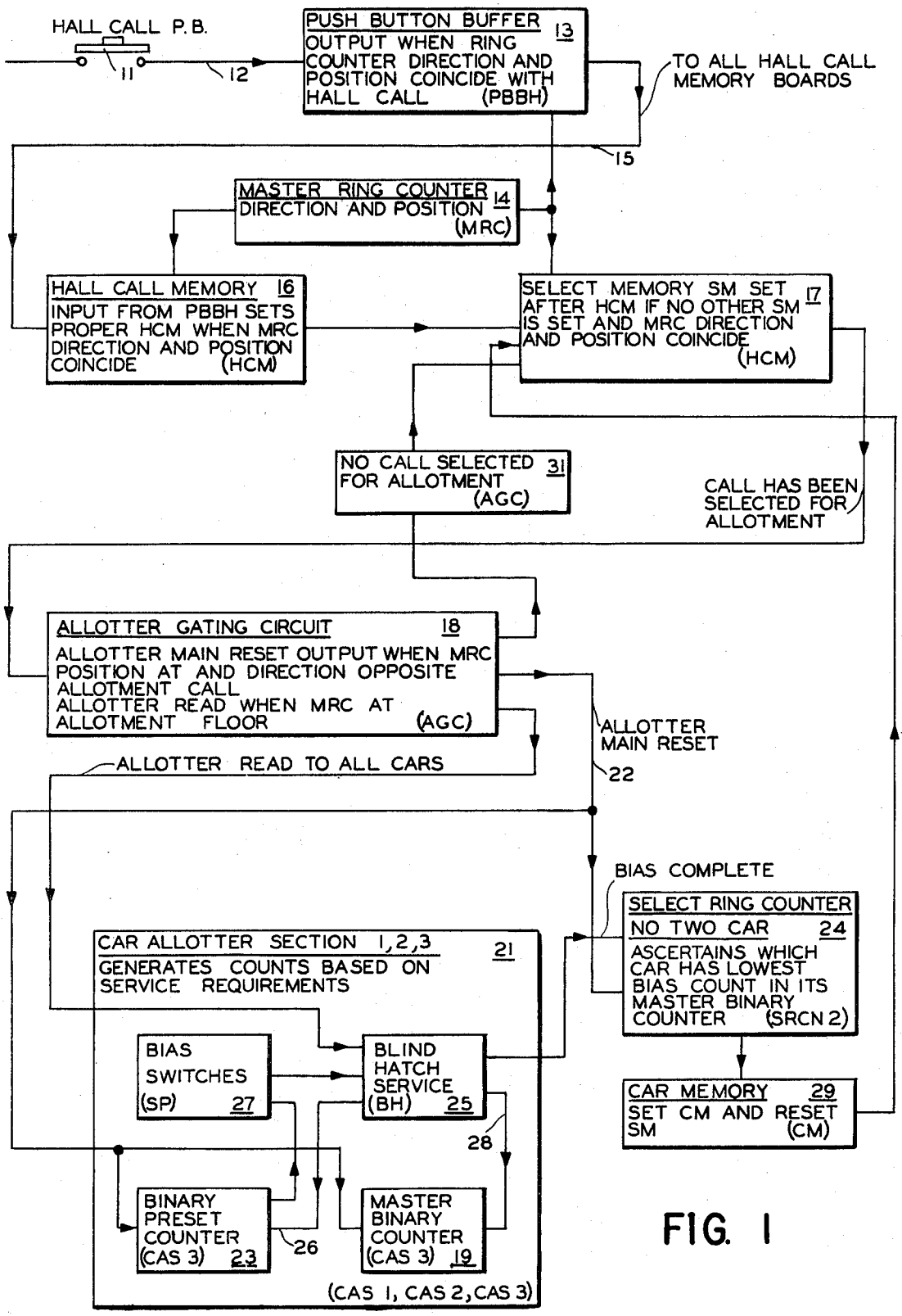

HALL CALL P.B.
11
12
PUSH BUTTON BUFFER 13
OUTPUT WHEN RING COUNTER DIRECTION AND POSITION COINCIDE WITH HALL CALL (PBBH)
TO ALL HALL CALL MEMORY BOARDS
15
MASTER RING COUNTER DIRECTION AND POSITION 14 (MRC)
HALL CALL MEMORY 16
INPUT FROM PBBH SETS PROPER HCM WHEN MRC DIRECTION AND POSITION COINCIDE (HCM)
SELECT MEMORY SM SET 17
AFTER HCM IF NO OTHER SM IS SET AND MRC DIRECTION AND POSITION COINCIDE (HCM)
NO CALL SELECTED FOR ALLOTMENT 31 (AGC)
CALL HAS BEEN SELECTED FOR ALLOTMENT
ALLOTTER GATING CIRCUIT 18
ALLOTTER MAIN RESET OUTPUT WHEN MRC POSITION AT AND DIRECTION OPPOSITE ALLOTMENT CALL
ALLOTTER READ WHEN MRC AT ALLOTMENT FLOOR (AGC)
ALLOTTER MAIN RESET
22
ALLOTTER READ TO ALL CARS
BIAS COMPLETE
SELECT RING COUNTER
NO TWO CAR 24
ASCERTAINS WHICH CAR HAS LOWEST BIAS COUNT IN ITS MASTER BINARY COUNTER (SRCN 2)
CAR ALLOTTER SECTION 1,2,3 21
GENERATES COUNTS BASED ON SERVICE REQUIREMENTS
BIAS SWITCHES (SP) 27
BLIND HATCH SERVICE (BH) 25
28
BINARY PRESET COUNTER (CAS 3) 23
26
MASTER BINARY COUNTER (CAS 3) 19
(CAS 1, CAS 2, CAS 3)
CAR MEMORY 29
SET CM AND RESET SM (CM)

FIG. 1

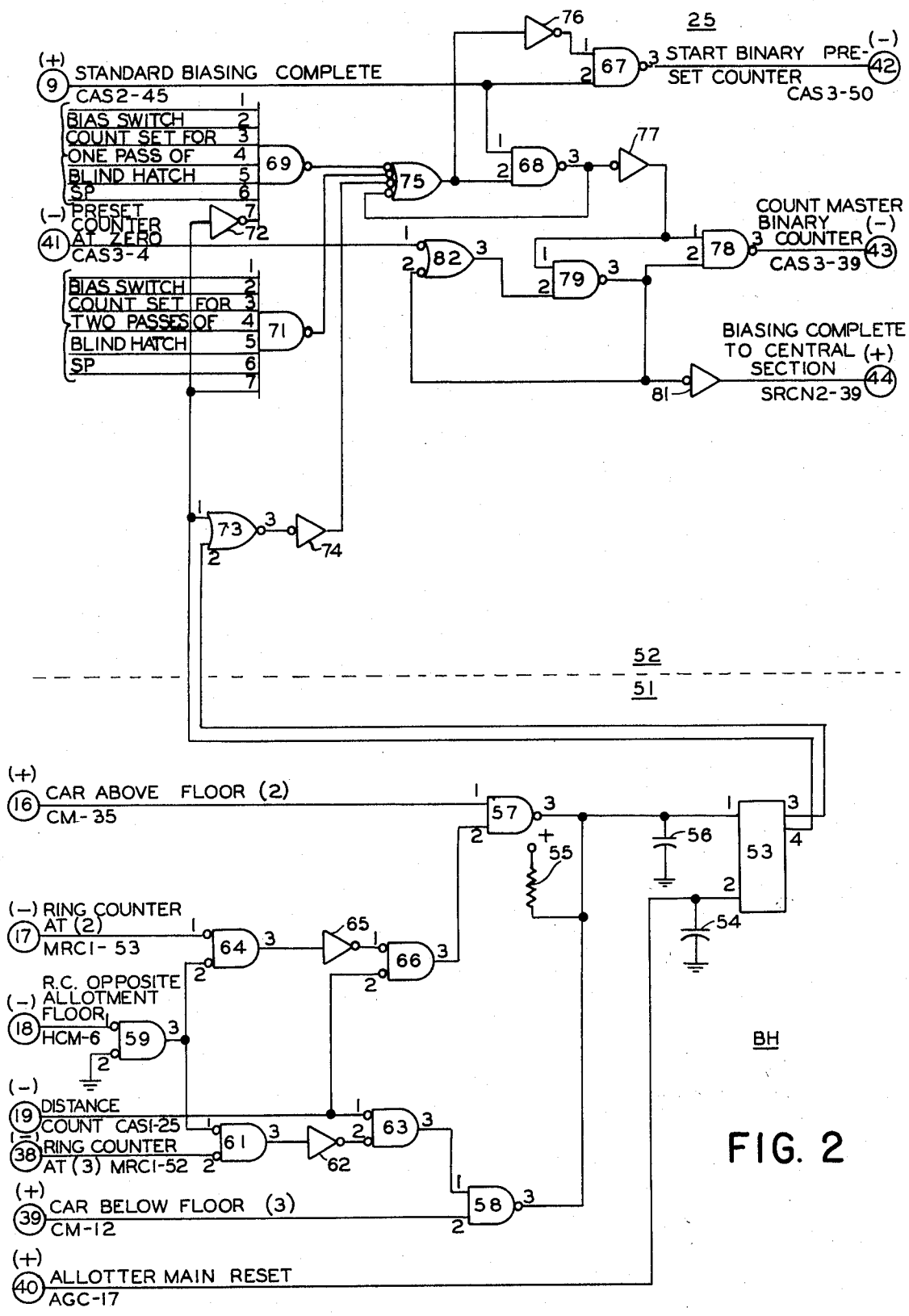

(+)
9
STANDARD BIASING COMPLETE
CAS2-45
BIAS SWITCH
COUNT SET FOR
ONE PASS OF
BLIND HATCH
SP
69
(-) PRESET COUNTER AT ZERO
41
CAS3-4
72
BIAS SWITCH
COUNT SET FOR
TWO PASSES OF
BLIND HATCH
SP
71
73
74
75
76
67
68
77
25
START BINARY PRE-SET COUNTER
CAS3-50
(-)
42
82
79
78
COUNT MASTER BINARY COUNTER
CAS3-39
(-)
43
BIASING COMPLETE TO CENTRAL SECTION
SRCN2-39
(+)
44
81
52
51
(+)
16
CAR ABOVE FLOOR (2)
CM-35
57
55
56
53
54
(-) RING COUNTER AT (2)
17
MRC1-53
64
65
66
R.C. OPPOSITE ALLOTMENT FLOOR
(-)
18
HCM-6
59
(-)
19
DISTANCE COUNT CAS1-25
(-)
38
RING COUNTER AT (3) MRC1-52
61
62
63
(+)
39
CAR BELOW FLOOR (3)
CM-12
58
(+)
40
ALLOTTER MAIN RESET
AGC-17
BH

FIG. 2

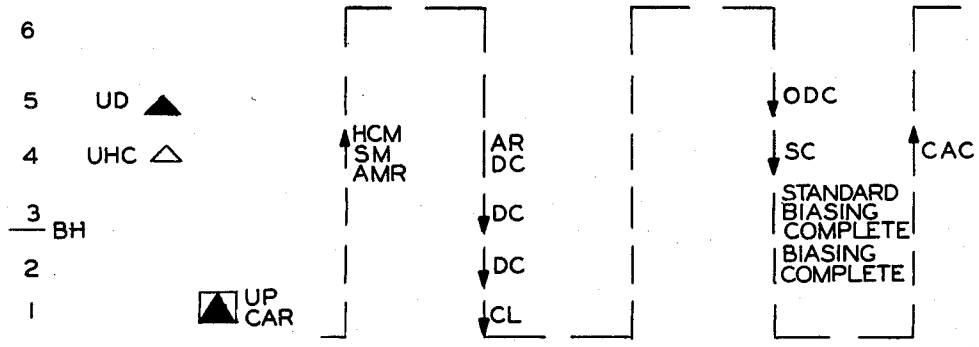
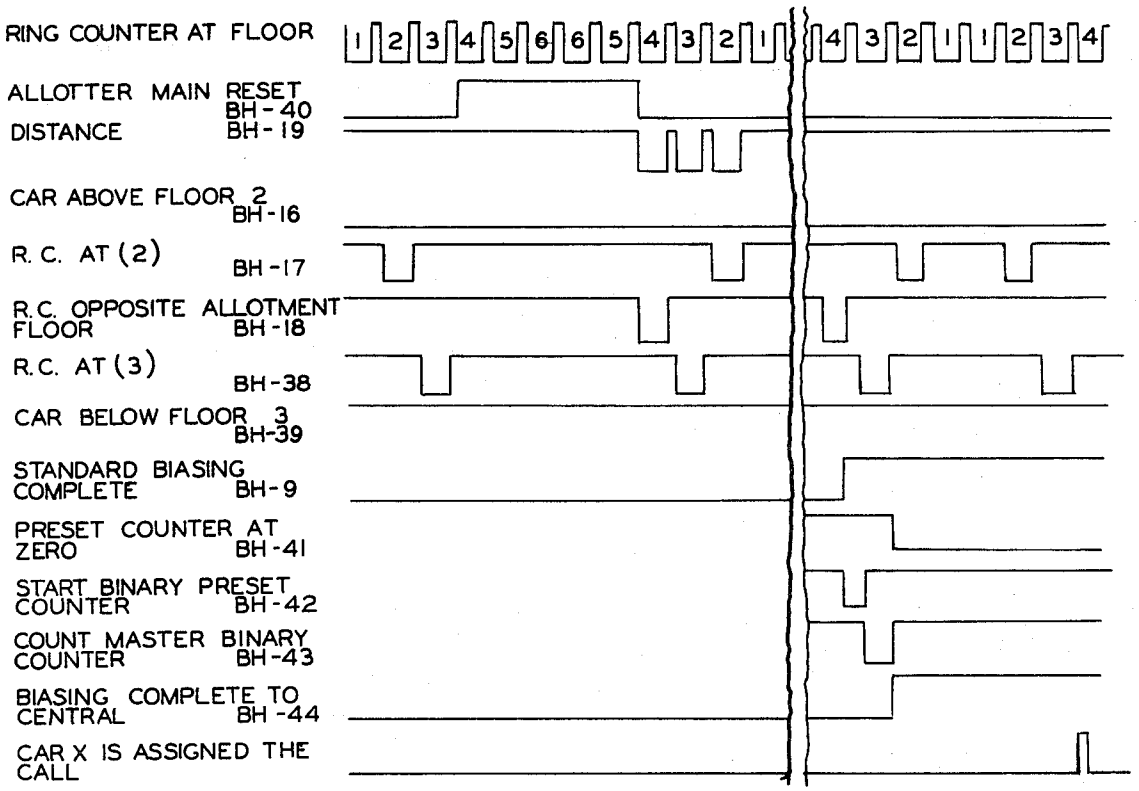

6
5
UD
4
UHC
3
BH
2
1
UP CAR
HCM SM AMR
AR DC
DC
DC
CL
ODC
SC
CAC
STANDARD BIASING COMPLETE
BIASING COMPLETE

FIG. 3

FIG. 4


RING COUNTER AT FLOOR
1 2 3 4 5 6 6 5 4 3 2 1 4 3 2 1 1 2 3 4
ALLOTTER MAIN RESET BH-40
DISTANCE BH-19
CAR ABOVE FLOOR 2 BH-16
R. C. AT (2) BH-17
R.C. OPPOSITE ALLOTMENT FLOOR BH-18
R.C. AT (3) BH-38
CAR BELOW FLOOR 3 BH-39
STANDARD BIASING COMPLETE BH-9
PRESET COUNTER AT ZERO BH-41
START BINARY PRESET COUNTER BH-42
COUNT MASTER BINARY COUNTER BH-43
BIASING COMPLETE TO CENTRAL BH-44
CAR X IS ASSIGNED THE CALL

ELEVATOR CONTROLS FOR SYSTEMS HAVING WIDELY SPACED LANDINGS

CROSS-REFERENCE TO RELATED APPLICATIONS

The specific example of an elevator control set forth to illustrate this invention is related to the elevator control of U.S. Patent application Ser. No. 151,778 entitled "Elevator Control For Optimizing Allotment Of Individual Hall Calls to Individual Cars" which was filed in the name of Gerald D. Robaszkiewicz.

BACKGROUND OF THE INVENTION

This invention relates to elevator controls for systems wherein operations are dictated by the spacing between a car and a destination and wherein a car serves a plurality of landings spaced by relatively uniform travel increments and at least one pair of landings which are abnormally spaced a distance several times the normal increment. Heretofore, it has been know to scan and count landings between a car and a destination as a means of ascertaining the required travel of the car.

N. C. Smart Pat. No. 2,114,506 of April 19, 1938 discloses a system for assigning individual hall calls to the car having the shortest travel to the landing of the hall call as ascertained by a step-by-step scan on a per landing basis from the landing of the call in a direction opposite the call service direction. The first car encountered traveling opposite the scan direction is assigned the call. Thus each landing scanned represented an increment of travel.

D. L. Hall et al. Pat. No. 3,511,342 issued May 12, 1970 discloses a system which evaluates the service capability of each of a plurality of cars with respect to a hall call to predict which car can serve the hall call most expeditiously and to assign that hall call to that car. One factor considered in the prediction is the travel distance from the hall call to be assigned to each of the several cars available for assignment. A step-by-step scan is instituted from the landing of the hall call to be assigned in a direction opposite the service direction of that hall call which imposes a per landing count on counters individual to each car in the system. Where the travel increments between landings are relatively uniform the accumulated count can be related to a service burden for each car with a high degree of accuracy. However, where the travel increment between landings is not uniform a count of landings to be traversed does not provide a true evaluation of the predicted service burden imposed by the travel distance between the car and call. One example of a long travel increment is a blind hatch wherein one or more elevators traverse a number of floors of a structure through a hatchway in which no landing openings are provided. Such applications of the Hall et al. system result in a count for the landings above and below the blind hatch and no count or other consideration for the travel through the blind hatch. This inaccuracy becomes particularly significant in the evaluation of predicted service burden where a car may require no traverse of the long travel increment region while others may require traverses of that region and still others only one traverse. Such situations arise where a blind hatch region in the lower portion of travel and above a main landing has a number of landings above the blind hatch region. A car in the region above the blind hatch can serve a call in that region by a continued advance toward the call, a reversal in the region to run to the call, or if previously committed, to run to the main landing by a double traverse of the blind hatch. The same call could be served by a car below the blind hatch by a single traverse of the blind hatch. Thus, it will be noted that substantial differences in car travel result without the cars being required to pass corresponding landings. The present invention recognizes and corrects the predicted travel where the increment of travel between successive landings is substantially different for one pair of landings than for others.

Other systems have recognized the distortion of individual landing considerations where blind hatch zones are treated as individual landings.

Pat. No. 2,936,858 issued May 17, 1960 to S. A. Hornung et al. attempts to increase the efficiency of service at the lobby where some of the elevator cars must traverse a lower blind hatch zone. A point in the blind hatch zone is selected at which a down car leaving the landing immediately above the zone will attain full speed. When a down car passes this point, a signal in the lobby indicates that it will be the next car to be dispatched so that the waiting passengers have time to assemble in front of the doors. This decreases the loading time and thus increases the efficiency of the system.

Pat. No. 3,519,104 issued July 7, 1970 to J. Suozzo et al. is concerned with blind hatch operation when answering hall calls. Generally, elevator cars servicing an upper zone will tend to terminate service in the lobby where they await reassignment. If a hall call is assigned to a car waiting in the lobby the car must travel the blind hatch zone with a resultant loss of time. The Suozzo patent attempts to overcome the blind hatch delay by running available cars at the lobby in excess of, for example, two upward to the first floor above the blind hatch zone to make them available for anticipated calls in the upper zone.

SUMMARY OF THE INVENTION

In the above cross-referenced Hall et al. patent and Robaszkiewicz application means are disclosed for precisely defining service factor values for elevator systems. In the application a pulse count proportional to the delay caused by each service factor is accumulated in a counter to indicate the total service burden. Service factors that are to be considered are distance to the hall call usually as the number of floors to be traversed for the car to reach the call to be allotted; the number of inside demands, hall calls that have already been allotted to the car for landings between its present location and the landing of the allotment call; the number of outside demands, hall calls that have already been allotted to the car for landings spaced from the car in required car travel beyond the allotment call; the number of inside commands, car calls in the car for landings between its present position and the landing of the allotment call; the number of outside commands, car calls in the car for landings spaced from the car in required car travel beyond the allotment call; the degree of loading of the car; the stopping status of car operation (if it is in a stopping mode) as accelerating, decelerating or standing with its door open; the state of its operating equipment, such as the m-g set not running; and its assignment for special service, as at a lobby awaiting load in the manner of a queue car. Each car has a master binary counter in which the counts,

which may be considered to anticipated service time, for all the service factors are totaled. Then the totals for each car are compared to determine which car is predicted to be in a condition to most expeditiously serve the call to be allotted and to all of that hall call to that optimum car.

In an installation where blind hatch operation is involved the blind hatch region has been disregarded as a region of travel between two landings. Thus while each traverse of the blind hatch required travel time in excess of that travel for a run between normally spaced landings it is treated as a single landing delay in servicing the hall call. The present invention discloses means to generate a signal representative of the time required to traverse the blind hatch specifically a series of pulses proportional to that time. This pulse series is not restricted to the interval each landing is scanned. As it is generated, it is added to the total in the master binary counter of the car to produce a more accurate service burden with which to optimize the allocation of a hall call.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a functional diagram illustrating the service evaluation means in a call finder-allotter for a plural car elevator system utilizing time sharing techniques which includes blind hatch operation;

FIG. **2** is a logic diagram for the blind hatch service factor;

FIG. **3** is a diagram of a scan sequence for an allotment function for six landings showing the relationship for a blind hatch located between the second and third landings; and

FIG. **4** is a fragment of a diagram of the various signals generated during the allotment of FIG. **3** on a time basis.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For illustrative purposes, the blind hatch service factor will be considered as it is applied to the elevator control disclosed in the above cross-referenced patent application. When a hall call is received by the elevator control it is stored in a memory until it is selected for allotment to a car. Upon selecting a hall call for allotment, a master ring counter causes each landing to be scanned for the presence of service factors. A system of time-sharing of signals is employed whereby the signals for each landing are gated only during the brief period the master ring counter is at the scan position corresponding to that landing, and in some instances, only when the master ring counter scan and scanning position are correlated with the landing and the service direction associated with the call or with a car position.

The presence of each service factor signal generates a pulse train with the number of pulses being proportional to the delay caused by the service factor. The pulse trains for the several service factors for each car are accumulated in a counter to obtain a total service burden for the car. The total burdens are then compared to determine which car has the lowest burden and thus should be allotted the hall call.

The functional block diagram of FIG. **1** represents the call finding and allotting signal flow for a time-sharing system including the service evaluation means and car assignment means. The service evaluation means contains the blind hatch factor generating means of the present invention. Each section of the system has been assigned a combination of letters to facilitate identification and to aid in designating input and output terminals for a discussion of hardware. The following symbols are used:

PBBH	push button buffer board
MRC	master ring counter
HCM	hall call memory
AGC	allotter gating circuit
CAS **1, 2, 3,**	car allotter sections **1, 2** and **3**
SP	bias switches
BH	blind hatch service
SRCN2	select ring counter no two car
CM	car memory
SM	select memory

All of the sections of the system except the blind hatch service module are illustrated in greater detail in the noted Robaszkiewicz patent application.

Anticipated service burden is indicated in the illustrative system as proportional to the length of a pulse train gated to a counter for each car during a read interval associated with each landing scan interval. During that read interval, a number of pulses are gated for the traverse distance or traverse time required of the car if it is to serve that landing in satisfying its current requirements or the call subject to analysis for assignment. Car or hall call pulse trains are also imposed following the distance pulse train and during the read interval if the car is committed to serve such calls at that landing.

Where a large number of landings are to be scanned the read interval of each scan becomes significant in establishing the period of the scan cycle of the landings. In order to limit the length of the read interval for each landing to that required for normal landing spacing distance and calls, the signal for blind hatch service burdens is imposed as a pulse train instituted when the scan of the landings has been completed. When considered at this time, the pulse train representing the service burden or travel time of the car across the blind hatch region can be of a length independent of the read interval for each landing and of any length necessary to maintain the burden relationship in pulse count to the other burdens considered.

The depressing of the hall call push button **11** of FIG. **1** initiates the allotting sequence and the predicted service burden signal generation for each car. This places a signal on input line **12** to set the proper push button buffer board **13** (PBBH). The range of car travel is scanned by a master ring counter **14** (MRC), which scans in an ascending order of floors, followed by a reversal to scan in a descending order of floors. The output signal from PBBH **13** is only present on line **15** when the MRC **14** direction and position coincide with the floor and direction of the operated hall call push button **11.** The output signal on line **15** is sent to the corresponding hall call memory **16** (HCM) for the floor of the call. Time sequencing of the MRC **14** codes the input to set the HCM **16** for the floor and service direction of the call.

If no other call is being allotted, as indicated in the hall call memories by all select memories being off, the call is selected for allotment when the MRC **14** position and direction correspond with the set hall call memory. This sets the select memory **17** (SM) to indicate to the allotter gating circuit **18** (AGC) that this hall call has

been selected for allotment. This occurs coincident with MRC 14 scan position and direction.

Allotment is based upon the count accumulated in each car's master binary counter 19 in the car allotter section board 3 (CAS3) of the car allotter section 21. An initial step in each allotment, therefore, is to reset the allotter by applying to it an ALLOTTER MAIN RESET signal on line 22 from AGC 18. This occurs when the MRC 14 is at a scan position of the allotment floor in the direction of allotment call service. The reset signal resets the binary preset counter 23 and the master binary counter 19 in CAS3, and thus the count held in each car's master binary counter 19. It also resets the select ring counter no two car 24 (SRCN2) employed in each selection of a car to be assigned a call.

When the MRC14 returns to the allotment floor with its direction opposite that of the service direction of the hall call to be allotted, a signal is generated in HCM16 which is transmitted to AGC18. As a result of this signal, the ALLOTTER MAIN RESET signal is turned off and an ALLOTTER READ signal from AGC18 is sent to all cars. The ALLOTTER READ signal consists of a train of pulses, one for each floor as the MRC14 scans the range of car travel, and each pulse is sent to each car's allotter section 21.

During the allotter read interval for each floor, each car is checked for a demand or a command at the floor by car allotter section 1 (CAS1 not shown) and if either is present a pulse series is gated into that car's master binary counter 19 to represent the service burden it imposes. A travel distance pulse series for the floor is also inserted in the car's master binary counter if it must traverse the floor to reach the allotment call.

A pulse generator, not shown, in CAS3 is the source for the pulse series that is passed to each car's master binary counter 19. When the ALLOTTER READ signal turns on, each car is checked for a demand at the floor in CAS1. A preset signal from CAS1 on line 26 is applied to the binary preset counter 23 to count pulses generated by the pulse generator if there is a demand at the floor. If there is no demand, no demand count is permitted. If a demand exists, the binary preset counter 23, which has a count capacity of 64 before resetting, counts the binary complement of the demand pulse series as set by a biasing switch 27 (SP). When the count in the binary preset counter 23 reaches the bias setting for demands, a count signal is sent on a line corresponding to line 28, for the call factor required, to the master binary counter 19 to admit the remaining pulses. Now the master binary counter contains a count representing a demand. In a similar manner, command and distance counts may be entered during the read interval for each landing.

After the scan for allotter read functions, a check of car status for each car is initiated. The car allotter section board 2 (CAS2 not shown) is activated and each car is checked for such factors as load, m-g set operating status and car stopping mode with the appropriate number of counts being gated into the master binary counter 19 of each car. After these evaluations are complete, the blind hatch service board 25 is activated to impose a count for a single traverse of the blind hatch region if the car will traverse that region before reaching the call under evaluation or an additional count if the blind hatch region must be traversed twice by that car. The completion of this final step produces a BIAS COMPLETE signal as an input to SRCN2 24 to start the process of selecting the car having the lowest bias count in its master binary counter. When the car is selected, its car memory 29 (CM) is set for the landing and service direction of the allotment call and the SM17 is reset. To insure that only one hall call is subject to allotment at a time a NO CALL SELECTED FOR ALLOTMENT signal 31 is applied to SM 17 so that only one SM can be set. If two cars have the same low bias count, SRCN2 24 selects one of them to receive the allotment call based on a predetermined order of preference.

FIG. 2 is a logic diagram for the blind hatch service factor. In order to facilitate an understanding of the logic elements and the associated terminals, the system of identification introduced in the above cross-referenced application will be utilized. A circuit module or board symbol, in this case BH for blind hatch service, will be combined with a terminal number and a logic sign to designate each circuit module or board terminal and the signal applied to or transmitted from it. The circuit module or board terminals are numbered within the circles adjacent the margins of the figure. A 1 or true logic signal will be designated parenthetically as (+) while a (−) will represent a 0 or false signal. Therefore, BH−9+ represents a positive going or logical 1 signal applied to terminal 9 of the blind hatch service board 25 (BH). In addition, adjacent each terminal is the designation for the terminal from which or to which the signal is applied.

Each logic element is designated by a reference number and the element terminals also have numbers. Therefore, 53-1 will represent input terminal 1 of element 53 which is a four-bit binary counter. Counter 53 counts pulses applied at input 53-1 and produces a binary output from 53-3 and 53-4. A 1 on reset lead 53-2 causes outputs 53-3 and 53-4 to go to 0. When a 0 appears on reset lead 53-2 the counter is enabled. The first pulse will produce a 1 on output 53-3 and a 0 on output 53-4. This occurs when the signal on input 53-1 changes from 1 to 0. The next pulse produces a 0 on output 53-3 and a 1 on output 53-4. A third pulse produces a 1 on both outputs and a fourth pulse switches both outputs to 0. Succeeding pulses cause the sequence to be repeated.

Element 57 is a NAND gate which produces a 0 on the output when both inputs are at 1. Any other combination of inputs changes the output to 1. Element 62 is an inverter which changes a 1 to a 0 or a 0 to a 1. Element 63 is a NOR gate which has a 1 output when both inputs are at 0 and a 0 output for any other combination of inputs.

Element 73 is a NOR gate in negative logic and functions in the same manner as element 63. Element 75 is a NAND gate in negative logic and functions in the same manner as element 57.

During the generation of the counts for the service factors the master binary counter 19 of FIG. 1 first receives counts representing demands, commands and distance from CAS1 and then counts representing the several static service factors from CAS2. The bias complete signal from CAS2 activates the blind hatch service factor 25 (BH) which generates a count if the car being checked must traverse a blind hatch.

The blind hatch service factor logic 25 is separated into two parts, 51 which counts the number of traverses of the blind hatch area and 52 which generates a count

proportional to the predicted service burden or time required for the car to make the number of traverses for use in the master binary counter. Output from the blind hatch logic is inhibited until the STANDARD BIASING COMPLETE signal is present as BH-9+ from CAS2-45 developed in circuits shown in the copending Robaszkiewicz patent application. Thus during the reading of each car's service conditions for the landings BH-9– prevents the issuance of any count and at the end of the reading of each car's service conditions for the landings and of the other bias conditions for each car the blind hatch bias conditions for that car are sensed.

Three possible blind hatch bias conditions exist. A car may require no traverses of the blind hatch to serve the allotment call as where the allotment call is on the same side of the blind hatch region as the car, provided the car is not committed to a call on the opposite side of the blind hatch region which it would serve prior to reversing to serve the allotment call. A car may require one traverse of the blind hatch to serve the allotment call as where the car is on one side of the blind hatch region and the allotment call is on the opposite side of that region. A car may require two traverses of the blind hatch to serve the allotment call when the allotment call is on the same side of the blind hatch region as the car and the car is committed to serve a call on the opposite side of the blind hatch region to which it would travel in the normal course of operation before traveling to the allotment call. Where no traverse of the blind hatch region is required, logic section **51** of the blind hatch logic module causes logic section **52** to issue a BIASING COMPLETE TO CENTRAL SECTION as a BH-44+ when a BH-9+ is received as STANDARD BIASING COMPLETE through NOR **73.** When one traverse of the blind hatch region would be required of the car a count representing that service burden is controlled by NAND gate **69** of logic section **52** and issued as an enable for a count input to the car's binary master counter, a COUNT MASTER BINARY COUNTER signal, as BH-43–. Two traverses of the blind hatch region are represented as a greater count by an enable signal BH-43– for a greater portion of the preset binary counter pulse train as controlled by NAND **71.**

Conditions are established for the control of NOR **73,** NAND **69** or NAND **71** during the read cycle of the landing scan which precedes the standard biasing for each car. Counter **53** responds to these conditions by establishing a binary zero count with outputs **53-3**– and **53-4**– when no blind hatch traverse is required of the car. It establishes a binary one count as **53-3**+ and **53-4**– to enable NAND **69** if one traverse of the blind hatch region is required of the car. If two traverses are required, counter **53** makes **53-3**– and **53-4**+ to enable NAND **71.** Traverse count logic is enabled only during those scan positions in which a DISTANCE COUNT count signal BH-19– is imposed to signify that landings are being scanned by the ring counter which the car is committed to traverse prior to serving the allotment floor.

In the exemplary system disclosed in the Robaszkiewicz patent application, when the master ring counter is at the allotment floor in the direction of the allotment call, an ALLOTTER MAIN RESET signal BH-40+, resets counter **53** to 0 output. The next time the allotment floor is encountered, the scan is in the opposite direction and the reset signal is removed, imposing a BH-40– to enable counter **53.** NAND gates **57** and **58** are connected in parallel to input **53-1** which is held at logic 1 by a resistor and power supply. If either NAND goes to logic 0 a count will be produced from counter **52.** If the elevator car is below the floor above the blind hatch zone, gate **58** is enabled. If the elevator car is above the floor below the blind hatch zone, gate **57** is enabled.

The relationship of car travel commitments prior to serving the allotment call to the car position relative to the limits of the blind hatch region are indicated through NANDS **57** and **58.** A car is considered for service burden evaluation purposes to be required to make a traverse of the blind hatch region if it has not completed the traverse at the time of evaluation and thus a traverse downward is indicated on NAND **57** even if the car is in the blind hatch moving downward and immediately above the landing defining the lower limit, the second landing, and a traverse upward is indicated on NAND **58** even if the car is moving upward and immediately below the landing defining the upper limit.

A count advance signal a logic 0 at **53-1** can be imposed only while NORs **66** and **63** are enabled by a DISTANCE COUNT signal, BH-19–, from CAS1-25 of the noted patent application disclosure, and only when one of those NORs are gated as the ring counter scan position is at a floor bounding the blind hatch region, the second or third landings in the example. When the car is above the blind hatch region the ring counter causes a traverse count by counter **53** while it scans the floor below the blind hatch by gating NOR **64** to gate NOR **66** and gate NAND **57.** When the car is below the blind hatch region the ring counter causes a traverse count by counter while it scans the floor below the blind hatch by gating NOR **61** to gate NOR **63** and gate NAND **58.** An inhibit can be imposed on NORs **64** and **61,** during the scan by the ring counter of the landing adjacent the blind hatch region in the direction of the hall call memory being allotted if the landing of the allotment floor is a landing which is immediately above or below the blind hatch region so that the gate **64** or **61** is gated only once for a scan upward and downward of the floor. This inhibit is provided by the signal RING COUNTER OPPOSITE ALLOTMENT FLOOR as a BH-18– when the scan is at the allotment floor in the direction of service required of the call being allotted.

A logic 0 on output **53-4** and a logic 1 on **53-3** designates that one traverse is required and NAND **69** is enabled by inverter **72.** If output **53-4** logic is 1, NAND **71** is enabled to designate two traverses of the blind hatch zone. Inputs **1** to **6** of NAND gates **69** and **71** represent binary numbers 1, 2, 4, 8, 16 and 32 respectively. By connecting some inputs to the outputs of a preset binary counter and the others to a positive power supply, the output of the NAND will switch from logic 1 to logic 0 when the preset counter reaches a predetermined number placing all inputs at logic 1. This change in state then switches the pulse train from the preset binary counter to the master binary counter which is accumulating the service burden total for the car. When the counting is complete the BIAS COMPLETE signal is generated to begin the comparison of burdens.

FIG. 3 illustrates the scan sequence for an allotment function involving six landings. There is an up car at the first landing which has been assigned an up demand at the fifth landing. In addition there is an up hall call at the fourth landing which is being allotted. A blind hatch area is present between the second and third landings so that the car must traverse the blind hatch area once to service the hall call. FIG. 4 is a diagram of the various signals present on the terminals of BH 25 during the allotment function shown on a time base.

The RING COUNTER AT FLOOR signal of FIG. 4 is actually a composite of the signals present on the individual floor outputs for purposes of illustration. When the ring counter reaches floor four the hall call HCM and select memories SM are set and the ALLOTTER MAIN RESET AMR signal is produced by AGC-18 as input BH-40+ to BH 25 count section 51. Referring to FIG. 2, this signal resets the 4-bit binary counter 53 at input 53-2 after a delay caused by charging capacitor 54. This reset signal makes outputs 53-3 and 53-4 go to zero where they are held until the reset signal is removed. As the ring counter scans down the fourth landing scan position is again encountered which produces BH-40— and the allotter read AR signals. At the same time CAS1 will now generate a distance count DC for each landing the car must traverse in its normal travel in order to reach the hall call so BH-19— is generated at floors four, three and two during the down scan.

The count input 53-1 of 4- bit binary counter 53 is being held at logic 1 by a positive voltage on resistor 55 which charges capacitor 56. A count is produced at outputs 53-3 or 53-4 when input 53-1 switches from logic 1 to logic 0. This may be accomplished by producing a 0 from either NAND 57 or NAND 58. Since the car is below the second landing, input BH-16— from car memory CM-35 for the second landing puts a logic 0 on input 57-1 and a logic 1 is produced at output 57-3 during the entire scan sequence. Therefore, the logic 0, if one is to be produced under these conditions, will have to be provided by NAND 58 which is enabled with a logic 1 on input 58-2 produced by input BH-39+ from CM-12 for the third landing car memory signaling that the car is below the third landing.

Also present during the scan of the fourth landing position in the down direction of scan is RING COUNTER OPPOSITE ALLOTMENT FLOOR signal BH-18— as input to 59-1 of NOR 59. Input 59-2 is tied to ground to produce a logic 0 which makes the output 59-3 a logic 1 during the fourth landing scan by the ring counter. The not RING COUNTER AT (3) signal is BH-38+ so both inputs 61-1 and 61-2 of NOR 61 are logic 1 and the output 61-3 is logic 0. Inverter 62 produces a 1 at input 63-2 of NOR 63 while input 63-1 is provided with a 0 by BH-19— the DISTANCE COUNT signal. The output 63-3 is a logic 0 which is the input to 58-1 producing a logic 1 at output 58-3 so that no count is registered. At the next floor, floor three, BH-18+ on input 59-1 generates a logic 0 at output 59-3 which is also the input to 61-1. BH-38— on input 61-2 makes both inputs logic 0 and output 61-3 goes to logic 1. Inverter 62 puts a logic 0 on input 63-2 and BH-19— provides a logic 0 to 63-1 producing a logic 1 from 63-3 to input 58-1 to enable NAND 58. Since input 58-2 is continuously provided with a logic 1 by BH-39+ the output 58-3 goes to logic 0 which grounds input 53-1 and counter 53 accepts one count which appears as a binary count 1 at output 53-3.

When the ring counter scan position is at the second landing, input 61-2 becomes logic 1 from a BH-38+. Thus output 61-3 is 0 which is inverted by 62 producing a logic 1 at 63-2 and another logic 0 at output 63-3. This logic 0 disables NAND 58 so that it produces a logic 1 on output 58-3. It may be seen from FIG. 4 that the count from counter 53 under the assumed conditions of FIG. 3 is only produced by the coincidence of the signals not RING COUNTER OPPOSITE ALLOTMENT FLOOR BH-18+, DISTANCE COUNT BH-19—, RING COUNTER AT (3) BH-38— and CAR BELOW FLOOR (3) BH-39+. In the scan illustrated by FIG. 3 this coincidence occurs only during the first down scan at the third landing.

If the positions of the car and the hall call relative to the blind hatch were reversed, for example, a down car at the fifth landing and a down hall call at the second landing, then the logic 0 would be generated by NAND 57. Input 57-1 would be logic 1 from BH-16+ since the car is above the fifth landing. This enables NAND 57. During the second up scan by the ring counter, the signals with the scan at the second landing will be BH-16+, BH-17—, BH-18+ and BH-19—. Input 59-1 is at logic 1 so output 59-3 becomes logic 0 which is the input 64-2 of NOR 64. The logic 0 at 64-1 produces a logic 1 output at 64-3 which is changed to a logic 0 by inverter 65 and is the input to 66-1 of NOR 66. The input 66-2 is a logic 0 from signal BH-19— so output 66-3 is a logic 1 to input 57-2. The logic 1 on each input to NAND 57 generates a logic 0 at output 57-3 and input 53-1 is grounded to produce a count.

If a car must traverse the blind hatch area twice to service a hall call, two counts will be generated, one each time the count landing scan is coincident with the distance count signal and a logic 1 will be generated at output 53-4 to represent the binary 2 count. This may occur, for example, if an up car below the blind hatch has a demand or command above the hatch and the allotment call is a down hall cald below the blind hatch. The RING COUNTER OPPOSITE ALLOTMENT FLOOR signal BH-18— prevents a double count when only one traverse of the hatch is involved but the positions of the car and hall call would cause two counts. This occurs where the hall call to be allotted is at the count landing, that landing bounding blind hatch region, and the car is on the other side of the blind hatch where the car will reverse at the allotment call. Thus, the car must traverse the blind hatch, pass the hall call and reverse direction to return to service the hall call. Since the DIRECTION COUNT signal begins at the hall call and ends at the car, but in a scan direction opposite the hall call a count will be generated at the start and also when the scan returns in the same direction as the hall call moving toward the car. For example, an up hall call for the second landing with no commitment for the car at the first landing would initiate the allotter read on a down scan at the second landing to issue a distance count signal BH-19—, then reverse and again issue a distance count signal on the up scan. Despite the fact that the car need only traverse the blind hatch downward it would product two counts without the count inhibiting function of signal BH-18—. The BH-18— signal when the ring counter is at the hall call or allotment floor and in the direction of the service direction of the hall call produces a logic 1 from 59-3. This

logic 1 makes outputs **61-3** and **64-3** logic 0. The logic 1 produced by inverters **62** and **65** generates a logic 0 at outputs **63-3** and **66-3** inhibiting NAND's **57** and **58** so that input **53-1** is logic 1 and no count is entered. When the scan is at the allotment landing and in the direction opposite the hall call, the not RING COUNTER OPPOSITE ALLOTMENT FLOOR signal BH-**18**+ and the count is entered.

Returning to FIGS. **3** and **4**, the down scan reaches the car at floor one where the car located signal CL is generated. The scan continues to look for outside commands and demands, an outside demand count ODC being registered at floor five, until the up hall call UHC is encountered in the opposite direction. The scan complete signal SC allows CAS2 to add the static service factors and then CAS2 generates a STANDARD BIASING COMPLETE signal BH-**9**+ which puts a 1 on inputs **67-2** and **68-1** of NAND's **67** and **68** of count generation section **52** to enable them.

The number of counts entered into the master binary counter **19** is determined either by NAND **69** for one traverse of the blind hatch or by NAND **71** for two traverses of the blind hatch. Binary preset counter **23** has a capacity of 64 counts and is used to provide signals to selected inputs of NAND's **69** and **71.** When the preset number is reached all inputs become logic 1 changing the output to logic 0 and generating the COUNT MASTER BINARY COUNTER signal BH-**43**— which causes the remainder of the 64 counts of the preset counter **23** to be entered into the master binary counter **19.** Then the BIASING COMPLETE TO CENTRAL SECTION signal BH-**44**+ is generated so that the call may be allotted to the car with the lowest bias count at which time a car assigned call signal CAC ends the allotment function.

In the example of FIG. **3** the car traversed the blind hatch area one time so counter output **53-3** was logic 1 and output **53-4** was logic 0. The logic 0 from **53-4** is the input **71-7** of NAND **71** so that the output of NAND **71** will remain at logic 1 during the counting cycle. The logic 0 is changed to logic 1 by inverter **72** to enable NAND **69** on input **69-7.** If, for example, 30 counts is the number selected to represent the service burden of one traverse of the blind hatch then the last 30 counts of the 64 count cycle are to be entered into the master binary counter **19.** Input leads **69-1** through **69-6** represent the binary numbers 1, 2, 4, 8, 16 and 32 when a 1 is present on them. The inputs representing the binary complement of the number of counts desired are connected to the corresponding outputs of the binary preset counter **23.** In this case, the number 30 would be a logic 1 on input **69-2** for a binary 2, a logic 1 on input **69-3** for a binary 4, a logic 1 on oinput **69-4** for a binary 8, and a logic 1 on input **69-5** for a binary 16. The binary complement would be 33 or a logic 1 on input **69-1** for a binary 1 and a logic 1 on input **69-6** for a binary 32. **69-1** and **69-6** are connected to the binary 1 and 32 outputs of the binary preset counter **23.** To make all inputs logic 1 at count 33 inputs **69-2** through **69-5** are connected to biasing switches SP**27** which provide the logic 1 signals. The coincidence of logic 1's produces a logic 0 on the output of NAND **69.**

Before the blind hatch traverse count is registered by counter **53** both outputs **53-3** and **53-4** are at 0. This makes inputs **73-1** and **73-2** logic 0 which produces a logic 1 changed to a logic 0 by inverter **74.** The logic 0 input to NAND **75** makes the output logic 1 which is changed to logic 0 by inverter **76.** The logic 0 input **67-1** makes output **67-3** logic 1 and prevents the binary preset counter **23** from counting. Since the STANDARD BIASING COMPLETE not signal is BH-**9**—, the logic 0 on input **68-1** makes output **68-3** logic 1 which is changed to logic 0 by inverter **77.** The logic 0 input to **78-1** of NAND **78** produces a logic 1 output at **78-3** and the master binary counter is also prevented from counting. The logic 0 on input **79-1** of NAND **79** produces a logic 1 at output **79-3** which is changed to a logic 0 by inverter **81** to signal that the biasing is not complete.

If no blind hatch traverse is required, counter **53** issues logic 0 to **73-1** and **73-2** to inhibit the binary preset counter **23** and directly issue a BIASING COMPLETE TO CENTRAL SECTION. NOR **73** issues a logic 1 at **73-3** inverted by **74** to make its input to **75** a logic 0 whereby a logic 1 inverted at **76** to a logic 0 inhibits NAND **67** so that its output is a logic 1 and no start signal is issued to the preset counter **23.** Under these conditions the preset counter remains at zero and BH-**41**— makes **82-1** a logic 0. NAND **68** has a logic 1 at **68-2** so it issues a logic 0 inverted to a logic 1 to **79-1.** Since the preset counter at ZERO signal makes **82-3** issue a logic 1 NAND **79** issues a logic 0 at **79-3** which is inverted at **81** to make BH-**44**+ and indicate biasing complete.

A logic 1 on output **53-3** representing the requirement that the car make one traverse of the blind hatch to serve the allotment call or a logic 1 on output **53-4** for two traverses of the blind hatch changes NOR output **73-3** to logic 0 which is inverted by inverter **74** placing a 1 on the third input to NAND **75.** This inhibits the immediate issuance of the biasing complete signal and enables the start signal to the binary preset counter. When the STANDARD BIASING COMPLETE signal BH-**9**+ appears, input **67-2** becomes logic 1 producing a logic 0 output at **67-3** which is the START BINARY PRESET COUNTER signal BH-**42**—. As the binary preset counter **23** counts, input **69-6** will be logic 0 until binary 33 is reached where all inputs become logic 1 and a logic 0 output produces a logic 1 output from NAND **75.** The logic 1 is changed to logic 0 by inverter **76** and a logic 0 input at **67-1** produces a logic 1 output at **67-3.** This turns off the START BINARY PRESET COUNTER signal.

With BH-**9**+ and NAND **75** indicating a preset count is not complete by issuing a logic 1 NAND **68** has both inputs at 1 which produces a logic 0 output. The logic 0 is changed to a logic 1 by inverter **77** and is the input **78-1** of NAND **78.** Since the binary preset counter is not at zero the BH-**41**— signal has become BH-**41**+ and is at input **82-1** of NAND **82.** Input **82-2** was at logic 1 from output **79-3** so output **82-3** is logic 0 which is input **79-2.** Output **79-3** remains at logic 1. Now both inputs to NAND **78** are at logic 1 so output **78-3** becomes logic 0 which is the COUNT MASTER BINARY COUNTER signal BH-**43**— to gate pulses of the binary preset counter clock to the master binary counter **19.** When 30 counts have been registered by the master binary counter **19** the binary preset counter **23** is at 63 and the next count changes the PRESET COUNTER AT ZERO signal to BH-**41**— . This generates a logic 1 at output **82-3** to input **79-2** making output **79-3** a logic 0. The logic 0 on input **78-2** removes the COUNT MASTER BINARY COUNTER signal by changing output **78-3** to a logic 1. The logic 0 on output **79-3** is

also inverted by inverter **81** to provide the BIASING COMPLETE TO CENTRAL SECTION signal BH-44+ so that the car with the lowest bias count may be ascertained when the bias counts for all cars have been completed.

If the car traverses the blind hatch twice, output **53-3** is 0 and output **53-4** is 1. The 1 is changed to a 0 by inverter **72** to inhibit NAND **69** which will produce only a 1. Assuming the service burden for two traverses is chosen to be represented by binary sixty the complement will be logic 1 on input **71-1** for a binary 1 and a logic 1 on input **71-2** for a binary 2. Inputs **71-1** and **71-2** are connected to the binary 1 and 2 outputs of the binary preset counter **23** while the other inputs to NAND **71** are connected to bias switches SP to provide logic 1 inputs. The coincidence of logic 1 inputs at count 3 enables the master binary counter **19** for the next 60 counts.

The present invention generates a signal representing the time delay caused by the travel of an elevator car through a blind hatch area. As applied to an elevator control which assigns hall calls to cars on the basis of service burden, the preferred embodiment generates a predetermined number of pulses to be counted by a master binary counter in each car. Other service factors are also represented by pulse series which are combined in the counter and the totals are compared to find the lowest count. The car with the lowest count is then assigned the hall call.

While the above detailed disclosure has been presented in terms of "blind hatch" traverses it is to be understood that it is contemplated for utilization in other situations where successively servable landings are spaced an abnormally long distance as where a zone of floors is set up to be bypassed and the scan evaluation of the bypassed floors is cut out. Further, the example employs the evaluation of the service burden imposed by commitments to traverse an abnormally long distance between landings to augment the over-all evaluation of several cars to serve a hall call subject to allotment although the travel evaluation might be employed in a single car system or for but one car of a plural car system, might be based on some other defined destination than a hall call to be allotted, and might be used for other than a car-selection-for-allotment factor.

It is to be understood that the system lends itself to modification both as to the individual elements thereof and their combination without departing from its spirit and scope. Accordingly, it is to be appreciated that the detailed example set forth above is for illustrative purposes and is not to be read in a limiting sense.

What is claimed is:

1. An elevator control for a car having an entry and serving a plurality of landings with said entry including at least one pair of successively servable landings spaced a first distance which is several times a second distance between another pair of successively servable landings comprising means for defining a destination for said car; first means for generating a first signal in response to the requirement that said car traverse said first distance between said one pair of landings in traveling from its current position to said destination; second means for generating a second signal in response to each requirement that said car travel to a landing servable thereby in traveling from its current position to said destination; third generating means for generating a third signal in response to the requirement that said car traverse said first distance between said one pair of landings upward and downward in traveling from its current position to said destination; signal accumulating means coupled to said first and second means for accumulating a signal characteristic of the travel distance for said car from its current position to said destination; and means to inhibit said first means and couple said third means to said signal accumulating means in response to the requirement that said car traverse said first distance upward and downward in traveling from its current position to said destination.

2. An elevator control according to claim **1** wherein said first means generates a first signal proportional to said first distance; wherein said second means generates a second signal proportional to said second distance; and wherein said third means generates a third signal proportional to double said first distance.

3. An elevator control for a car having an entry and serving a plurality of landings with said entry including at least one pair of successively servable landings spaced a first distance which is several times a second distance between another pair of servable landings; means for detecting a service requirement which requires travel of said car between said one pair of landings; means issuing a signal characteristic of the required travel of said car between said one pair of landings in response to said detection means; means for detecting a service requirement which requires travel of said car between said one pair of landings in both directions of travel; and means issuing a signal characteristic of the required travel across said first distance twice in response to said detection means.

4. An elevator control according to claim **1** wherein said first means generates a train of pulses of a number proportioned to said first distance; wherein said second means generates a train of pulses of a number proportioned to said second distance; wherein said third means generates a train of pulses of a number proportioned to double said first distance; and wherein said signal accumulating means is a counter.

5. An elevator control according to claim **1** wherein said means for defining a destination is a call for service at a landing; and service capability evaluating means responsive to the signal accumulated by said signal accumulating means.

6. An elevator control for each of a plurality of cars serving at least a plurality of common landings including at least one pair of successively servable landings spaced a first distance which is several times a second distance between another pair of successively servable landings comprising means responsive to a call for service at a landing at which each of said plurality of cars can provide service for defining a destination for said plurality of cars; first means for generating a first signal in response to each requirement that one of said plurality of cars traverse said first distance between said one pair of landings in traveling from its current position to said destination; second means for generating a second signal in response to each requirement that one of said plurality of cars traverse said second distance to a landing servable thereby in traveling from its current position to said destination; signal accumulating means coupled to said first and second means for accumulating a signal characteristic of the travel distance for each of said plurality of cars from its current position to said destination; service capability evaluating means for each car to indicate said car's service capabibity with

respect to the call defining said destination responsive to the signal accumulated by said signal accumulating means of said respective car; and means to assign that car to the call for service at said destination which has a predetermined service capability with respect to said call.

7. An elevator control according to claim **6** including means responsive to the presence of a car on the side of said one pair of landings on which said destination is located; means responsive to the commitment of a car to travel to a landing on the side of said one pair of landings opposite said destination; third means for generating a third signal of greater magnitude than said first signal; and means responsive to a coincidence of responses of said car presence responsive means and said service commitment responsive means for inhibiting said first means and enabling said third means to apply said third signal to said signal accumulating means.

8. An elevator control for a car having an entry and serving a plurality of landings with said entry including at least one pair of successively servable landings spaced a first distance which is several times a second distance between another pair of successively servable landings comprising means for defining a destination for said car; means for scanning servable landings between said destination and said car; means during the scan of each servable landing for generating a signal representative of the travel distance required of said car for said landing; means to accumulate said generated signals; means effective during the scan of said servable landings between said destination and said car to count the number of traverses of said first distance required of said car in traveling between said destination and said car; and means to apply a signal representative of the travel required of said car during said traverse to said signal accumulating means.

9. An elevator control according to claim **8** including means responsive to completion of the scan of the servable landings between said destination and said car to actuate said signal applying means.

10. An elevator control according to claim **8** wherein said signal generating means generates signal pulses and wherein said signal accumulating means is a pulse counter.

11. An elevator control according to claim **10** wherein said signal applying means applies signal pulses to said pulse counter.

12. An elevator control according to claim **8** wherein said traverse counting means includes means to sense the position of said car relative to a landing of said one pair of landings; means to sense the position of said scanning means at a landing of said one pair of landings; means to sense the commitment of said car to pass landings in travel between said destination and said car; and means to count a coincidence of a signal sensing the car beyond a landing of said one pair of landings on one side thereof, the presence of a scan at said landing of said one pair of landings on said one side thereof, and the sensed commitment for said car to pass said landing of said one pair of landings on said one side thereof.

13. An elevator control according to claim **8** including means for evaluating the availability of said car to serve said destination in response to the signal accumulated in said accumulating means.

14. An elevator control for a plurality of cars serving a plurality of floors wherein at least one of said cars must traverse a region in which there are no landings for a distance significantly greater than the distance between normal adjacent landings including means responsive to a hall call at one of said floors for detecting if each of said cars must traverse said region to service said call, means responsive to said detection for generating a service burden signal and means responsive to said service burden signal for evaluating the availability of each of said plurality of cars to serve said hall call.

15. An elevator control for a plurality of cars serving a plurality of floors wherein at least one of said cars must traverse a region in which there are no landings for a first distance significantly greater than a second distance between normal adjacent landings including means responsive to a hall call at one of said floors for detecting if each of said cars must traverse said region to service said call; first means for generating a first signal in response to the requirement that one of said plurality of cars traverse said first distance in traveling from its current position to service said hall call; second means for generating a second signal in response to each requirement that one of said plurality of cars traverse said second distance in traveling from its current position to service said hall call; third generating means for generating a third signal in response to the requirement that one of said plurality of cars traverse said first distance upward and downward in traveling from its current position to service said hall call; signal accumulating means individual to each one of said cars coupled to said first and second means for accumulating a service burden signal characteristic of the travel distance for said car from its current position to service said hall call; means to inhibit said first means and couple said third means to said signal accumulating means in response to the requirement that said car traverse said first distance upward and downward in traveling from its current position to service said hall call; and means responsive to said service burden signals for evaluating the availability of each of said plurality of cars to service said hall call.

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