

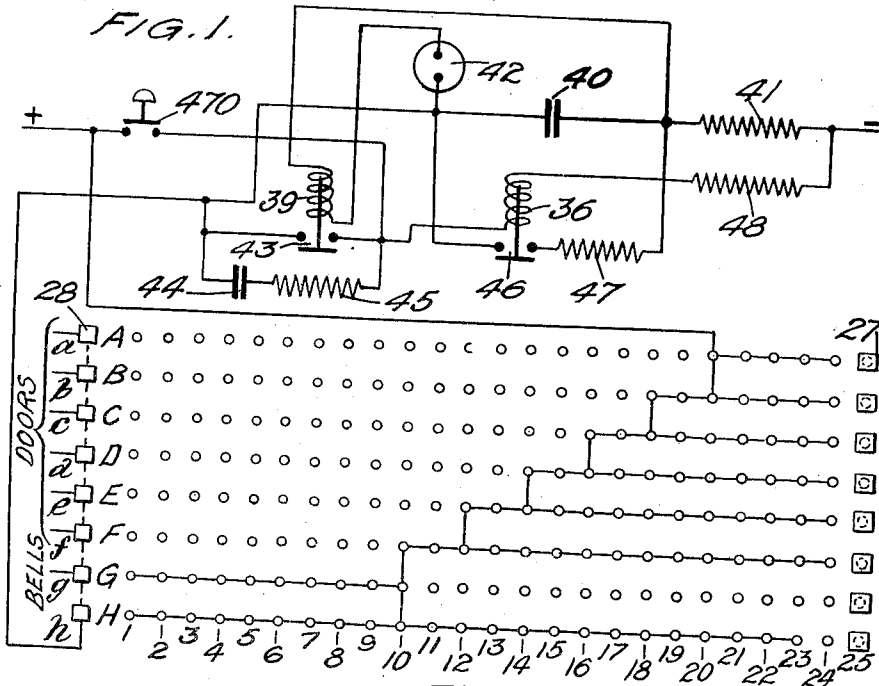
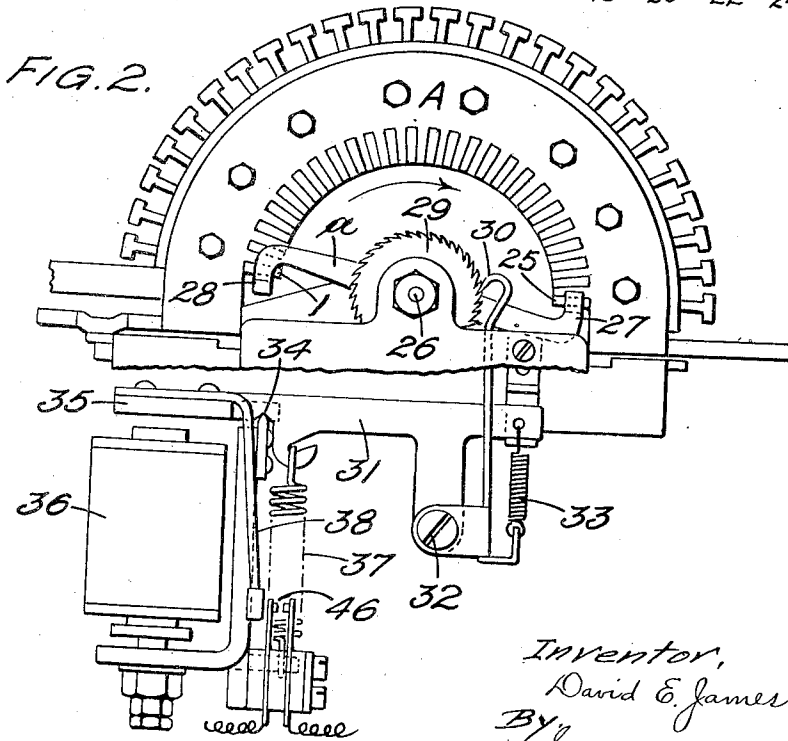
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BULKHEAD DOOR

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BULKHEAD DOOR

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This invention concerns improvements relating to the electrical control of bulkhead watertight doors and anti-piracy doors on ships, fire-proof doors in buildings and like remotely controlled doors.

In a known form of such remote control apparatus, a hand-wheel is provided which, when slowly turned, causes audible warnings to be sounded and hydraulic or pneumatic valves or electrical switchgear to be operated for actuating the doors, these effects being produced in proper sequence and at predetermined time intervals. It is an object of the present invention to provide a control apparatus by which the required timing is given automatically without it being necessary for the operator to turn a handle. A further object of the invention is to avoid the necessity, in the case of hydraulically and pneumatically operated doors, for carrying tubes to the central control point, generally the bridge of the ship.

In control apparatus according to the invention, the control operations are effected in a given sequence and with a given timing by an automatically driven controller or master switch the driving of which is initiated by a manual switch. The apparatus is preferably such that the driving means of the controller switch is adapted for being set in operation by an initial momentary closure of a self-opening manual switch, for thereafter maintaining itself in operation until the controller switch reaches an end position at the completion of door-closing control-operations, and for thereafter being set in operation to return the controller switch to its initial position, in which the doors are permitted to remain open, by a second momentary closure of the self-opening switch. The controller switch in the said end position maintains a condition of control in which the doors can be opened locally but are at once reclosed automatically.

Conveniently the controller-switch is of the nature of the selector-type of switch extensively employed in automatic telephony. The switch may be driven automatically by an electro-magnet periodically excited by the effect of the discharge from a condenser. The periodic discharge of the latter may be provided for by arranging across it a neon-discharge lamp which is "flashed" when the condenser-charge reaches a given value.

One embodiment of the invention as applied to a bulkhead door installation will now be described by way of example and with reference to the accompanying drawing, in which:

Fig. 1 is a circuit diagram of the control apparatus, and

Fig. 2 is a front elevation view of a selector switch.

The actual operation of the bulkhead doors may be performed electrically, hydraulically or pneumatically. The electrical control-apparatus hereinafter described involves only the replacement of the control-apparatus at present in use.

The usual principal requirements of the control apparatus will be that it should, upon its operation for closing the doors, cause an audible warning (for example by bell) to be sounded for a given time-period and only then produce closure of the doors, generally in a given sequence. Thereafter it should ensure the maintenance of supply to the door-closing mechanism, so that a door opened temporarily under the usual "local" control will be immediately reclosed. Upon operation for permitting opening of the doors, the apparatus should interrupt supply to the mechanism to allow the doors to be opened and should reset itself ready for a further door-closing operation.

In the illustrated embodiment of the invention, these operations are effected by electrical currents or impulses transmitted by a selector-switch of the type, employed in automatic telephony, which comprises a series or bank of superimposed semi-circular rows, A, B, C . . . of fixed contacts 1, 2, 3 . . . and wiping contacts or wipers a, b, c . . . movable together over the fixed contacts of respective rows by a common rotatable spindle 26. The number of fixed contacts will depend upon the size of the installation. In an installation requiring, say, 100-200 contacts, these contacts may conveniently be arranged in rows of twenty-five and in the instance illustrated there are eight rows A-H each of twenty five contacts 1-25. As the general construction of such selector-switches is well known it will not be described in detail: A connection from each wiper a-h is brought out through a slip-ring and spring-wire brush. Each wiper is double-ended and is arranged so that as one end 27 (Fig. 2) leaves the last contact 25 of the respective row A-H the other end 28 encounters the first contact 1 thereof. Each end 27, 28 is designed so that before it breaks with any one contact 1-24, of the row it has made with the next contact thereof. The wipers a-h are rotated unidirectionally, to wipe over the respective rows of contacts, by means of a ratchet-wheel 29 fast on the spindle 26. A pawl 30 is pivotally mounted upon a rocking member 31 at 32 and

is held against the ratchet wheel by a light spring 33. The member 31 is mounted upon a knife edge 34 and is connected to the armature 35 of an electro-magnet 36, the so-called stepping magnet.

5 A spring 37 acts upon the member 31 and the pawl is arranged to operate the ratchet wheel, under the influence of the spring 37, when the armature is released upon de-excitation of the magnet, the wipers being thus advanced by one

10 fixed contact at each operation of the pawl. As will be understood, the time thereby required for the wipers to traverse the rows of contacts depends upon the time-interval between successive de-excitations of the stepping magnet. By suitable allotment to the contacts of the circuits for the various control-operations, the sequence of the said operations and their durations can then be controlled for the whole installation. The

15 rocking member 31 also carries an arm 32 which serves to close contacts (hereinafter referred to) when the armature is attracted.

The required timing of the action of the stepping magnet 36 is obtained by exciting the winding 39 of an electromagnetic relay and a condenser 40 which is periodically discharged. The condenser is connected to the negative side of the supply through a high resistance 41 and the relay-winding 39 is connected, in series with a

20 neon-discharge lamp 42, across the condenser. When the condenser is also connected to the positive side of the supply, its charge will build up in a certain interval to a value sufficient for the voltage across it to "flash" the neon-lamp. This condenser-discharge through the relay excites the latter. The relay-contacts 43, across which a spark-quenching condenser 44 in series with a resistance 45 is connected, complete an exciting circuit for the stepping magnet 36 of the selector-switch, whose armature 35 is thereupon

25 attracted. Contacts 46 connected, through a resistance 47, across the condenser 40 are then closed by the arm 38 to complete the discharge of the condenser. These contacts 46 occupy the position of the usual "self-drive" of the selector

30 switch as used in automatic telephony, but are reversed as compared with the said "self-drive" contacts, that is they close when the armature 35 is attracted and open when it is released. The complete discharge of the condenser 40 results

35 in the windings 39 and 36 of the relay and magnet being deenergised, so that the armature 35 is released and the wipers of the selector switch are advanced by one fixed contact, whilst the condenser is left ready to receive a further charge

40 for the repetition of the cycle. The value of the high resistance 41 in series with the condenser determines the rate of charge of the condenser and therefore the interval between successive advances of the wipers. A resistance 48 is connected in series with the magnet winding 36.

45 A press-button switch 470 located at a central control point is connected between the stepping magnet 36 of the selector-switch and the positive side of the supply so that the said magnet can be initially energised directly from the supply by momentary depression of the press-button. The positive side of the supply is also connected directly to a selected number of fixed

50 contacts in every row. As illustrated, such connection is made to contacts 20-24 in row A, contacts 18-24 in row B, contacts 16-24 in row C, contacts 14-24 in row D, contacts 12-24 in row E, contacts 10-24 in row F, contacts 1-10 in row G, and contacts 1-23 in row H. Wipers

55 a-f are connected to the operating mechanism

of respective doors, say groups of doors at successive levels, wiper g to all of the warning bells, and wiper h to the condenser 40, relay contacts 43 and switch contacts 46.

The operation of the control apparatus is as follows:—

Let it be assumed that the selector switch is in the "off" position or position of rest, that is with one end (i. e. 27 in Fig. 2) of each wiper a-h on the respective unconnected contact 25 10 and the other end thereof (28 in Fig. 2) one step short of the respective contact 1. There is then no connection to the door-operating mechanism or bells or to the exciting apparatus for the stepping magnet 36. If now, the press-button switch 15 470 is momentarily depressed and released, the stepping magnet is directly energised and deenergised so that the wipers a-h (in Fig. 2, the ends 28 thereof) are advanced by one step to the respective contacts 1. At once, the bells are 20 set in operation by current passed over the wiper g and a charging circuit is established through the wiper h to the condenser 40, thereby initiating the above described cycle of charge and discharge by whose repetition the wipers are auto- 25 matically advanced step by step. Until the wipers reach the contacts 10, no door-operation takes place and the bells thus sound a warning for a given period which comprises a required multiple of the stepping interval. When the wipers reach 30 the contacts 10, a first group of doors is caused to be closed by current passing through the wiper f. Thereafter groups of doors are caused to be closed in succession by current passing through the wipers e-a, as respective contacts 12, 14, 16, 35 18 and 20 are successively reached. When contact 24 is reached, the charging connection to the condenser 40 is no longer established and the stepping action ceases, the wipers a-h, thus coming to rest upon respective contacts 24. All 40 the control operations have then been performed, but supply is maintained by the wipers a-f to the various groups of doors to ensure their reclosure after local opening.

If, now, the press-button switch 470 is again 45 depressed and released, the wipers a-h are stepped forward to the contacts 25 and stop there. Supply to the doors is interrupted so that they will remain open when they are locally opened. The control apparatus is now all ready for a 50 further door-closing operation.

The control apparatus may be arranged so that all doors, or only certain doors, can also be reopened from the central control-point.

The apparatus may, furthermore, be modified 55 by the provision of a dialing means at the control point and a row selector switch such as is used in automatic telephony, so that individual doors or groups of doors may be closed at will from the said control-point.

I claim:

1. Electrical control apparatus for controlling the operating means of remotely located doors such as bulkhead doors and the like, comprising a multiple switch having a plurality of contacts arranged sequentially for connection with the respective door-operating means for closing circuits to the door-operating means to operate the same as the multiple switch is actuated; electric means for actuating said switch to close 70 said contacts in sequence; a self-opening manual switch connected with said actuating means for controlling the excitation thereof to set said actuating means in operation by a momentary closure of said manual switch; and a further 75

contact on said multiple switch connected to said actuating means for maintaining said actuating means in operation until closure of all said sequentially arranged contacts, the multiple switch
5 in normal position closing no contacts but after actuation of said manual switch closing said further contact and then sequentially said door actuating contacts, said further contact being reopened before said door actuating contacts, which
10 are then reopened by another actuation of said manual switch, said multiple switch being cyclic in nature and ready for another similar actuation when desired.

2. Electrical control apparatus for controlling
15 the operating means of remotely located doors such as bulkhead doors and the like, compris-

ing a rotary switch having a plurality of contacts, circuits electrically connecting some of said contacts with the respective door-operating means, electric means for rotating said switch
5 stepwise, a starting switch for initiating the stepwise rotation of said multiple switch, said rotating means stopping said switch at a position short of the starting position, and means for completing rotation of the switch to starting position including a circuit controlled by the same
10 starting switch that initiates rotation of said multiple switch, said rotary switch being cyclic in nature and ready for another similar actuation when desired.

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