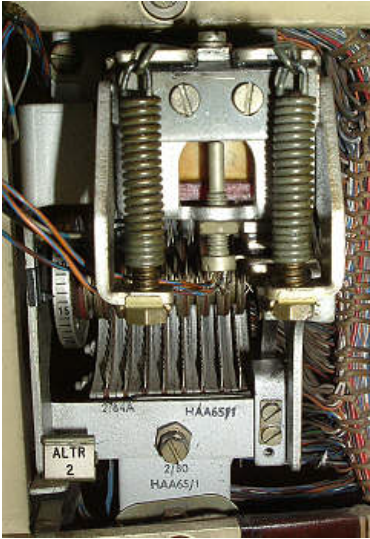


Introduction to Strowger

Strowger is an exchange system built around electro-mechanical switches that can drive or be stepped around a bank of outlets. The system can be considered to have the following characteristics.

- 1) Step by step control of the call.
- 2) Selection by means of magnet controlled mechanisms.
- 3) Interconnection via wipers and banks using base metal contacts.
- 4) Switching devices that usually have one or two inputs and twenty five to two hundred outlets.

There are two main types of switch.

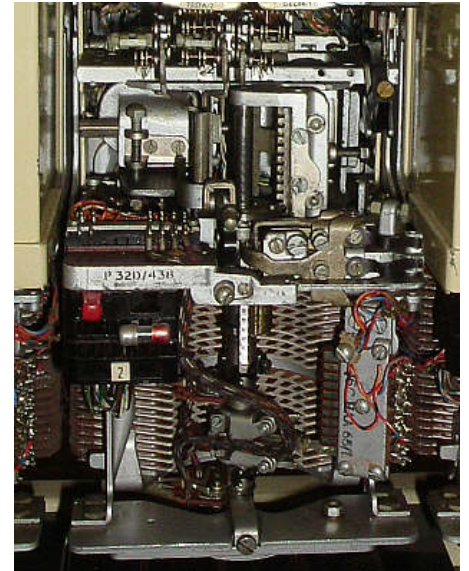


Uniselectors use up to eight wipers to drive or step over a bank of 25 outlets. One variation however uses two sets of four staggered wipers to provide a switch with four wipers and fifty outlets. This picture shows a uniselector with eight wipers selecting over twenty five outlets.

Two motion selectors have a bank laid out with ten levels of eleven outlets each. Up to eight such banks can be searched by sets of eight wipers. Generally the switch steps vertically to the side of the bank under the control of the caller's dial. It then searches over the selected level for one of ten outlets. The eleventh outlet usually returns busy tone when all outlets are engaged.

The last selector in a train is called the final selector and it steps both vertically and then horizontally under the control of the caller's dial to settle on the called number's bank position.

In larger exchanges it is usual to provide two sets of up to four wipers each, selecting over two sets of bank outlets. By careful circuit design this provides the equivalent of ten levels of twenty outlets per level.



This picture shows a two motion selector with four wipers selecting over ten levels of eleven outlets each. The selector is also equipped with a vertical marking bank and wiper which allows the selector to know which level has been selected so that it can provide the facility appropriate to that level.

Most selectors have an associated set of relays mounted on the same base plate. These are almost always Post Office 3000 type relays.

In some cases the selectors may be controlled by a separate relay set, often connected to the selector through a uniselector. This is the case in the UAX13 where the linefinders are controlled by a relay set which selects the linefinder to be used with a uniselector allotter.



Setting up a call through a Strowger exchange usually involves each dialled digit stepping a two motion selector vertically with each selector then driving into the bank to find a free selector in the next “rank”. The last digit though causes a final selector to step into the bank so that the wipers come to rest on the desired number.

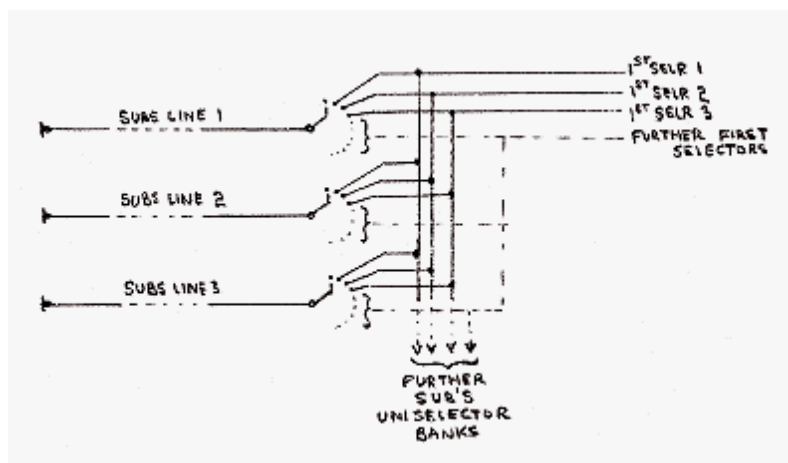
However it is not economic to provide all lines in an exchange with their own two motion selectors with which to initiate calls. It is always necessary to find an economic way to connect a calling line to a “first” selector when the caller wishes to make a call.

Such equipment is called **Preselection Equipment**.

In busy exchanges it is usually economic to provide each line with a uniselector (and two relays) which can hunt over its bank whenever the caller attempts to make a call. This approach is used in Director and Non-Director exchanges.

In quieter exchanges it is usually cheaper to provide each line simply with a set of relays which in turn can cause either a uniselector or a two motion selector to hunt and find the caller. This approach is used in UAXs and PABXs.

There are three main types of preselection equipment ie :



Sub's Uniselectors

A calling loop on a subscriber's line causes his uniselector to rotate to find a free first group selector. A second calling subscriber will set his own uniselector looking for a free first selector. It will, of course, hunt over the now busied outlet seized by the original caller.

Each caller has access generally to 23 or 24 first selectors.

At the end of the call the uniselector restores to its home position. In more modern equipment there are two home positions on outlets

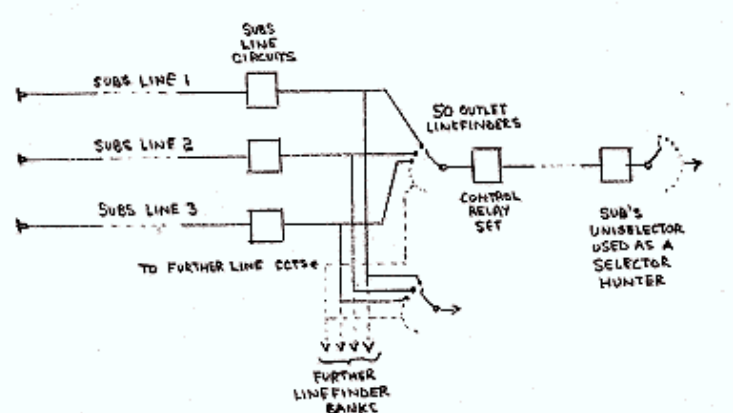
0 and 13. This reduces the selectors available by one but does allow any subsequent call to be made via a different first selector. This is particularly important during very quiet periods when a faulty first choice selector could isolate a group of subscribers.

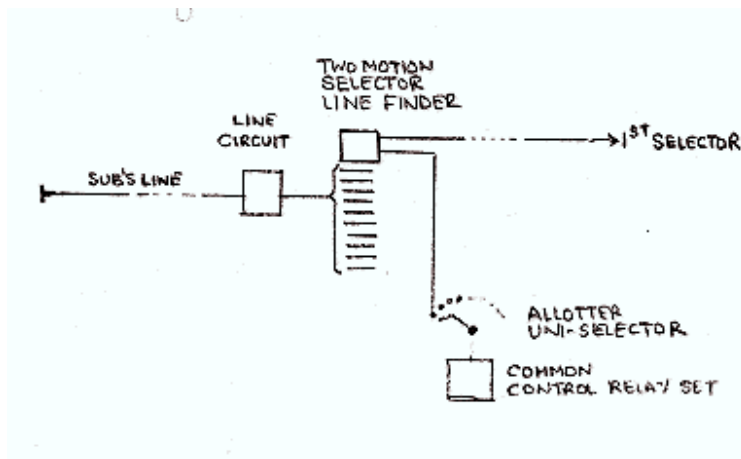
50 Point Linefinders

Most residential subscribers have quite low call rates and it was found uneconomical to provide such customers with a uniselector each. In the 50 point linefinder system, each subscriber only possesses a relay line circuit and a position on the banks of a small group of uniselector type linefinders. Fifty line circuits share the group of linefinders.

When a subscriber calls, his line circuit sends a start condition to one of the control relay sets and also marks the calling position on the bank of the group of linefinders. The control set causes the linefinder to hunt and switch to the marked outlet and at the same time extends the caller's loop to an ordinary subscriber's uniselector now to be used as a selector hunter.

The overall amount of uniselector mechanisms is much reduced by the use of this scheme for low calling rate customers.





200 Outlet Linefinders

This is an older scheme which was replaced by the above schemes as the calling rate per customer grew over the years. In this system a calling loop caused the line circuit to send a start condition to a control set and mark the level and outlet on the bank of the two motion selectors.

The control set had preselected a free linefinder via the allotter and then caused it to drive vertically to the marked level and horizontally to the marked outlet. When it found the outlet the loop was extended through to a first selector.

tor connected to the linefinder.

The allotter then stepped to the next free linefinder and the control relay set was released to handle a further call.

Note that twenty outlets were provided on each level, ie two per set of contacts. The linefinder could then switch to the odd or even wiper sets to select the required caller.

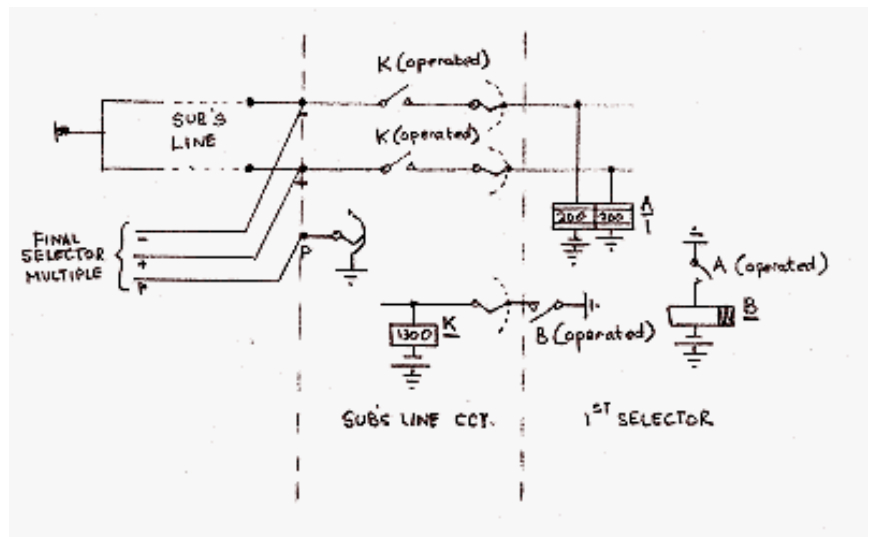
This system became very difficult to maintain as calling rates grew and it became necessary to cut down the number of customers on each line finder group to rather less than the two hundred envisaged originally.

Forward Loop - Backward Holding Conditions

Each type of preselection equipment provides a path from the subscriber's line to a first selector when a loop is received from the customer.

The customer's line is only two wires, represented as the - and + wires within the exchange. A third P (or private) wire is also needed within the exchange. This is used to find free outlets, to busy outlets when they are taken into use, and to hold equipment used to set up a call. In larger exchanges the P wire is also used to pass metering conditions back to operate a meter in the customer's line circuit.

The loop is passed forward from the preselection equipment to the first selector and the first selector then provides an earth on the third P wire in the exchange to hold the preselection equipment.



The Group Selector

A group selector is seized by the caller's loop being extended to it by the previous equipment. It returns a busy and holding earth on its incoming P wire to hold the previous equipment. If it is the first selector it also returns dial tone to the caller.

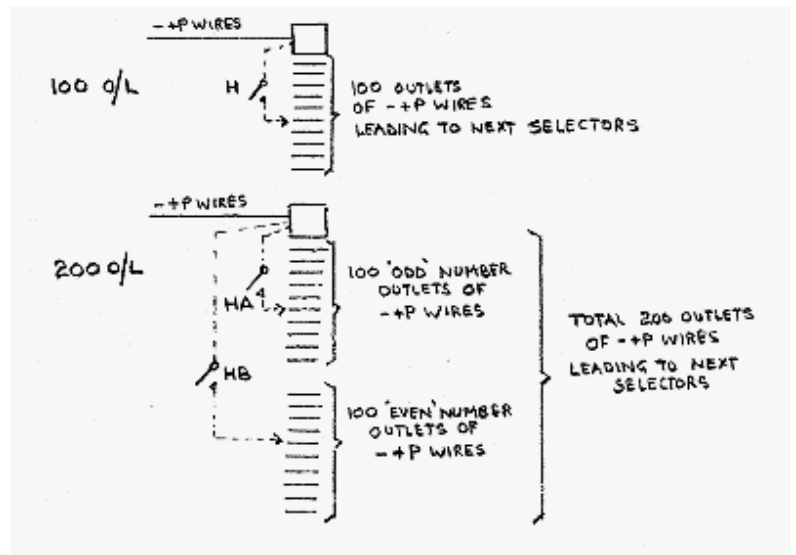
Note that a group selector can only handle a single digit and therefore any call through a large exchange requires ranks of group selectors in tandem.

When the caller dials a digit, it responds by stepping vertically to the level dialled.

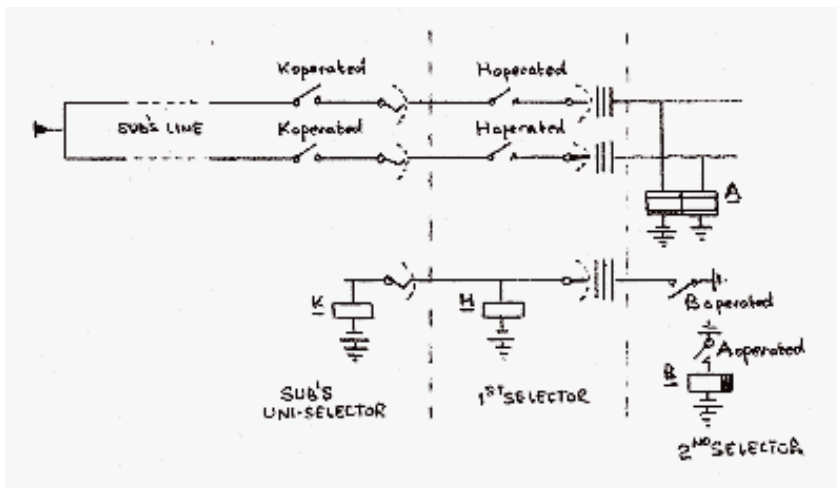
It then drives into the selected level looking for a free trunk to the next rank of selectors.

In some low calling rate environments there may only be ten outlets connected around the level but in the larger exchanges there will be twenty outlets available. Outlets one and two will be available on the first set of bank contacts and so on round the level. Two sets of wipers are needed to search the bank and the appropriate set is used when a free outlet has been found.

In large exchanges a free outlet is denoted by there being no condition on the P wire (ie a "dis"). This is replaced by an earth when it is busy. In smaller exchanges a free outlet is denoted by there being a low resistance "battery" on the P wire. Again it is replaced by an earth when it is busied.



Forward Loop - Backward Holding Conditions



When the selector switches to the next rank, the caller's loop is extended on to the next switch and the group selector holds to the earth returned on the P wire.

The Final Selector

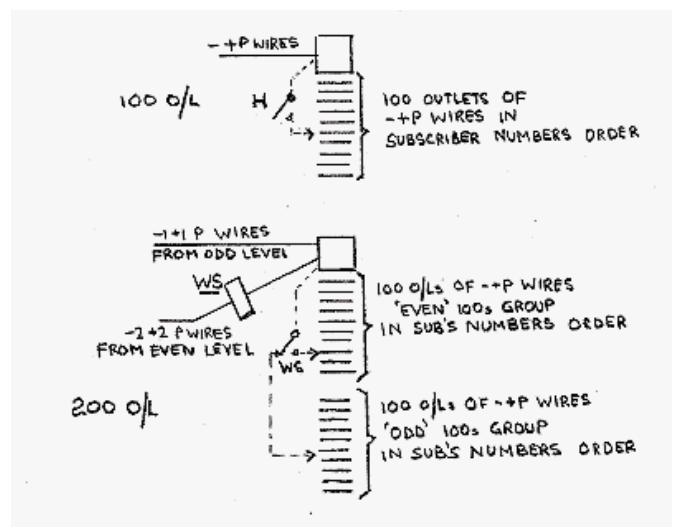
The final selector deals with the last two digits dialled by the caller.

It again seized by the caller's loop on the - and + wires and again it returns a busying and holding earth on the P wire.

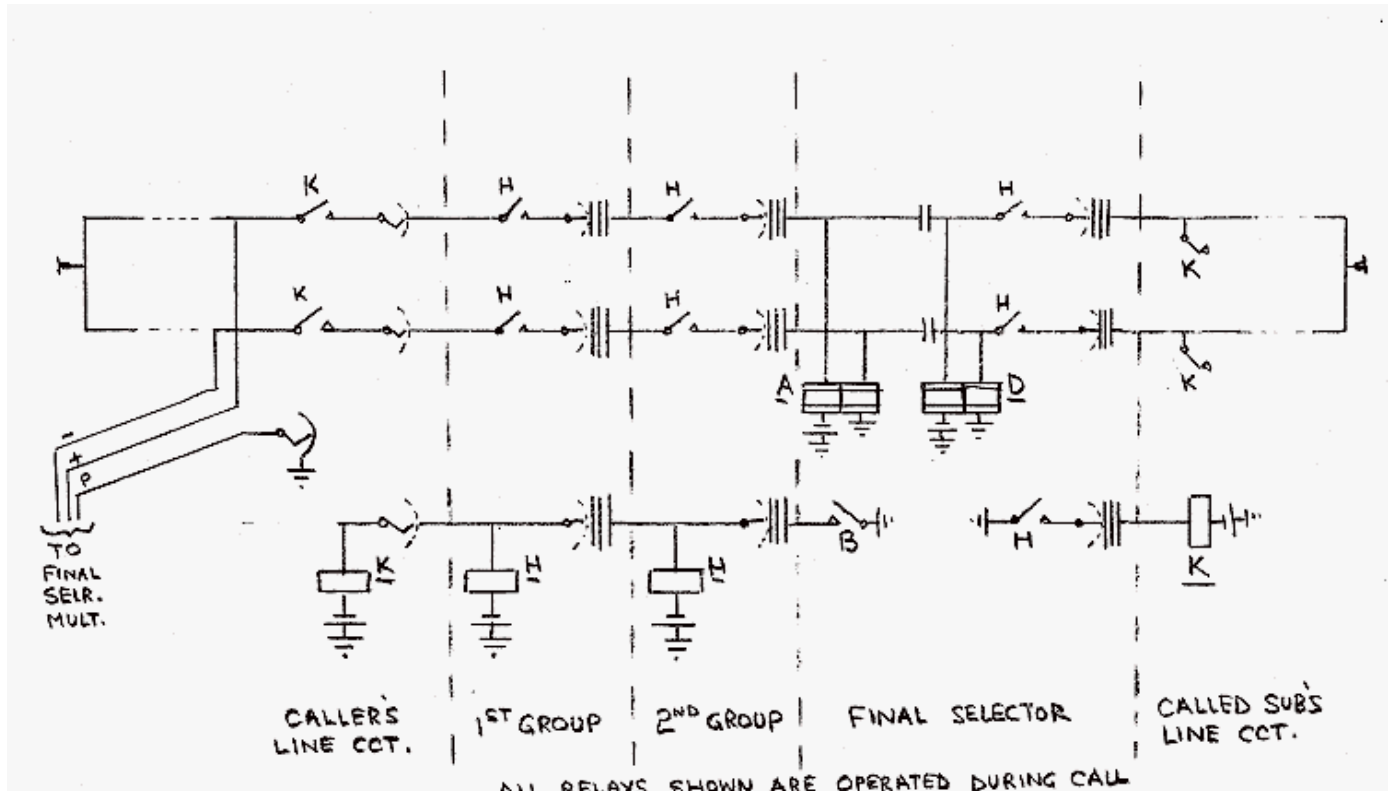
It then steps first vertically and then horizontally to rest on the called subscriber's number on the final selector bank multiple.

If the line is free, it busies the called subscriber's line circuit and then rings the called subscriber.

When they answer, the final selector connects the two customers together via a transmission bridge in the final and sends a metering pulse back to operate the caller's meter.



Final Forward Loop - Backward Holding Conditions



When the call is set up, the whole connection is held by the caller's loop holding the A relay in the final selector.

This in turn holds the B and H relays in the final.

The B relay holds an earth on the P wire from the caller which in turn holds the H relays in any group selectors and the K relay in the caller's line circuit.

The caller's unselector is "off-normal" and one of its wipers returns an earth onto the caller's final selector multiple so that his number is busied from anyone dialling it.

The final selector H relay holds an earth on the P wire to the called subscriber's line circuit to operate the K relay and to make the called subscriber busy against any one else dialling the number.

The final selector provides a transmission bridge with relays A and D feeding current to the two customers whilst the capacitors allow speech currents to pass between them.

At the end of the call the caller removes his loop and the final selector A, B and H relays release. B removes the earth from the P wire allowing all previous selectors to restore to normal. It is necessary though to guard the selectors during the time it takes them to restore. Each restoring piece of equipment earths its P wire during restoration.