

The Keysender (Keycaller).⁽⁴⁾ With the object of reducing the time taken in dialling, particularly on busy P.B.X. switchboards, a mechanical sender has been developed and is known as the Keysender No. 5. It is obtainable by subscribers on rental terms. The sender consists of a series of ten key levers mounted on a frame which also contains the code storage and impulse mechanisms carried on a central shaft.

The code storage device is a fixed circular ring carrying 100 steel pins held friction tight in holes drilled in the flange of the ring. In this sender, provision for an inter-digit pause of 600 mS is made; hence, in storing any digit, the pin spaced that digit plus six away from the previous projecting pin is pushed forward. The arrangement of the code storage and impulse sending mechanisms is shown in Fig. 52.

In addition to rotating about its own axis, the impulse wheel rotates by a "sun and planet" motion around the internal gear on the code storage ring. The cam $T1$ (Fig. 52) for the inter-digit pause is the length of the space between six pins. The gearing is so arranged that one impulse at the impulsing springs corresponds to the time taken for the cam to travel over the space between two successive pins. In the position shown in the drawing, the cam $T1$ is bearing against a projecting code pin and the other end of the cam is therefore raised and has lifted the impulse springs away from the impulse wheel, with the result that impulses are no longer being sent out. Thus, it will be seen that, by selecting code pins spaced $n + 6$ spaces apart, any digit sequences can be sent out having an inter-digit pause of 600 mS. Thus, to take the number 3621 again, the ninth pin is first selected, after which the sender proceeds to pulse out; selection of the pin twelfth away then follows, and so on.

The speed of pulsing out is controlled by a governor, as in the ordinary dial. Impulse trains are transmitted to the external circuit *via* the collector rings and their associated brushes.

Code Storage. The keysender is provided with ten key levers, the external portion being shaped similarly to the keys of a typewriter; the key levers are depressed by the operator in storing a code. The key lever restoring springs are attached to a spring grading bar which is sloped at an angle to even up the resistance to finger pressure over all the keys, the springs on the keys for the lesser digits having a higher initial tension.

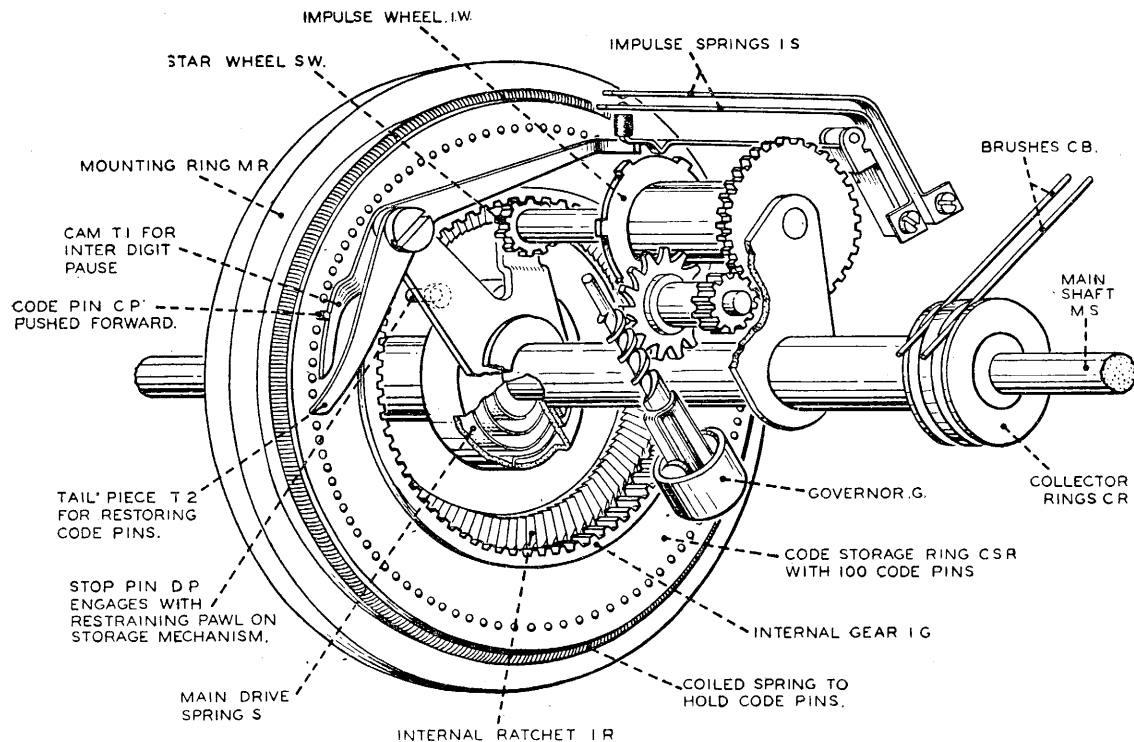


FIG. 52. CODE STORAGE AND IMPULSE SENDING MECHANISMS

When operated, all the digit keys travel through the same distance. The key pressures are light, being about 1 lb. 12 oz.

The code storage mechanism is shown in Fig. 53. Each digit key is provided with an adjustable shoe, *AS*, so that the point of engagement with the storage rocker *RP1* can be

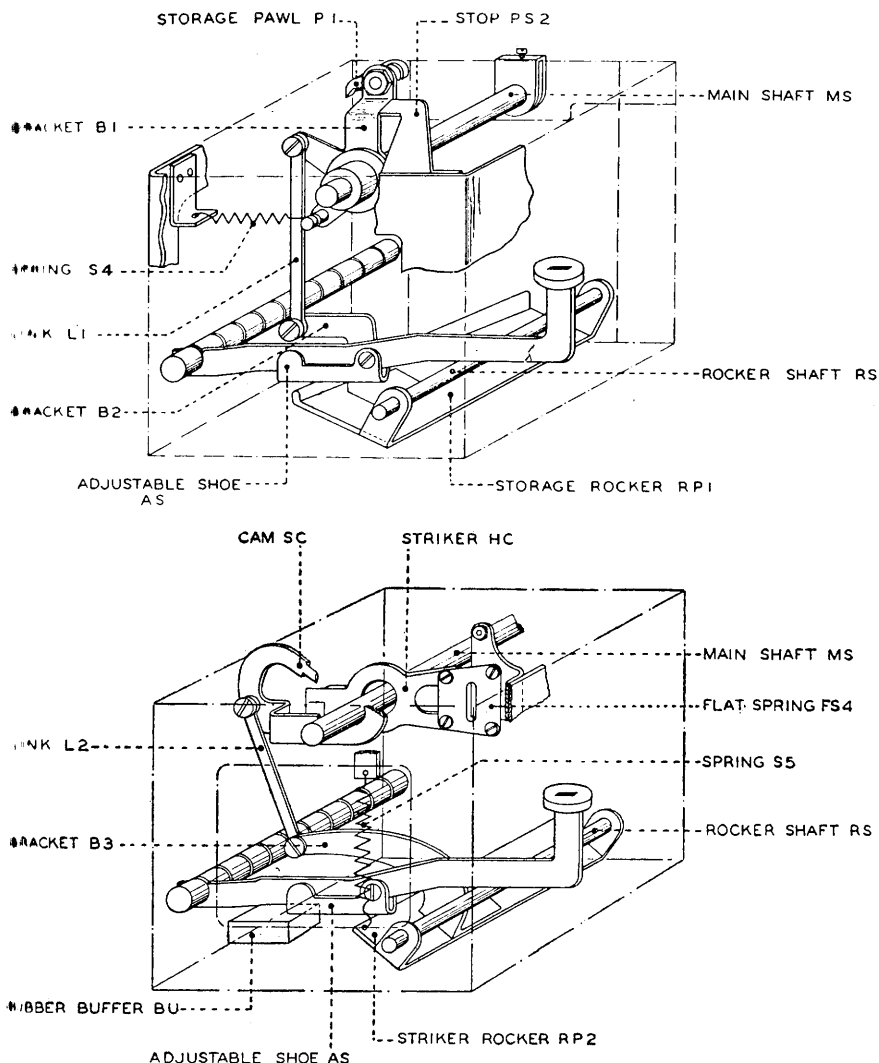


FIG. 53. CODE STORAGE AND STRIKER MECHANISMS

adjusted accurately. The movement of the storage rocker on the depression of a digit key is communicated to the storage pawl, *P1*, through the bracket *B2*, link *L1*, and bracket *B1*. The storage rocker is tapered so that for equal downward movements of the key levers, the correct angular movement of the storage pawl for each digit is obtained: when storing the digit "1" the storage pawl has an angular movement of $25^{\circ} 12'$, and of $56^{\circ} 36'$ when storing the digit "0." The storage pawl turns the ratchet wheel, *RW*, (Fig. 54), which rotates about the main shaft *MS* (Fig. 53). On release of the digit key, the storage pawl returns to the stop *PS2* under the pull of the spring *S4*. The ratchet wheel is carried back for a short distance until the locking pawl is operated by the locking lever.

The ratchet wheel is shown in Fig. 54. The marking arm *MA* is attached to the ratchet wheel by a flat spring *FS1*, which allows the outer end of the marking arm to be pushed forward against a code pin when the pins *CP* are hit by the striker.

The impulse mechanism restraining pawl, *P2*, is attached to the ratchet wheel by a helical spring, *S2* (Fig. 54). On the downward movement of a digit key, the ratchet wheel is stepped forward but the outer end of the restraining pawl, being held by an internal ratchet associated with the off-normal spring assembly, remains stationary and the spring *S2* stretches. The restraining pawl is held against the marking arm by a flat spring. In consequence, when the marking arm is hit by the striker, the restraining pawl is also pushed forward, is momentarily disengaged from the internal ratchet, and jumps to the new position of the ratchet wheel.

The squared end of the bearing, *RB*, which rotates with the ratchet wheel, engages in a D-bush anchored to the main spring driving the impulse mechanism; the impulse driving mechanism is therefore wound up through the correct angle on each rotation of the ratchet wheel.

On the depression of a digit key, the adjustable shoe also operates the striker rocker (Fig. 53), pulling down the cam *SC* through the intermediate bracket *B3* and link *L2*. The actual striker, *HC*, is attached to the frame by a flat spring, *FS4*. The end of the striker is so shaped that on the downward movement cam *SC* passes in front of the striker, pulling it away from the marking arm. On the return journey, however, the cam passes behind the end of the striker, so pushing it

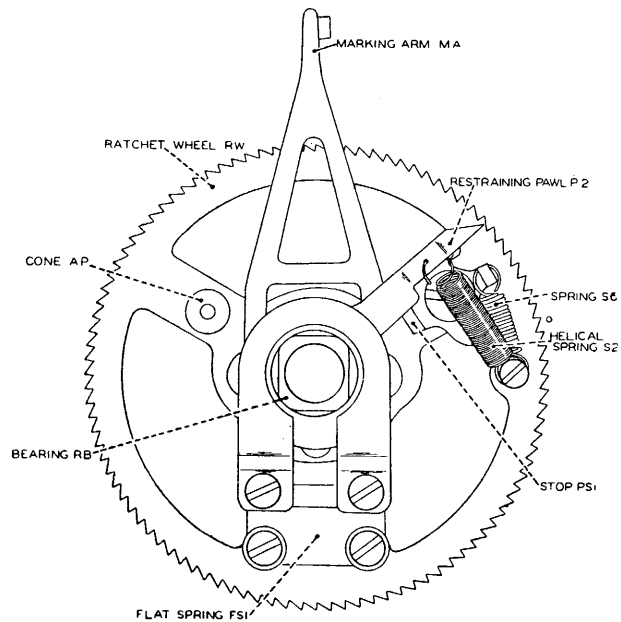
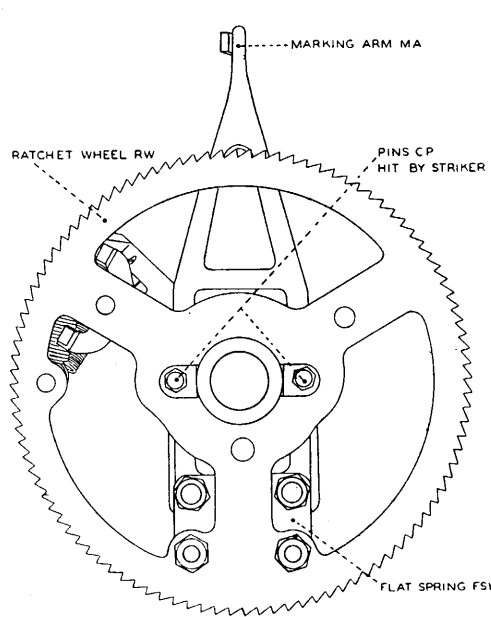


FIG. 54. RATCHET WHEEL

against the marking arm. This action sets the code pin and releases the restraining pawl; this must occur after the ratchet wheel has been locked in position.

The operation of code storage is therefore that, on the depression of a digit key, the ratchet wheel and marker arm are moved forward through an angular distance determined by the key depressed and arranged so that, when the ratchet wheel is locked into position after its slight return movement, the marking arm is opposite the code pin $n + 6$ spaces further around the code storage ring. Immediately afterwards, the digit key being released, the cam *SC* passes behind the striker *HC* which, in turn, pushes the marking arm against the code pin in front of which the arm has been positioned by the preceding mechanical operation. The selected pin is therefore pushed forward. Meanwhile, the forward movement of the restraining pawl has released the impulse-sending mechanism, and impulses commence to be sent out in the manner described.

The mechanism is provided with off-normal springs which are changed over on the first forward jump of the restraining pawl and remain in this position until the movement of the impulse-sending mechanism is finally arrested by the stop pin striking the restraining pawl on completion of pulsing out the digits stored on the code ring.

It will be seen from the description that the mechanism is unique in that it has no zero position, but comes to rest on the completion of any call, the actual position being determined by the final position of the restraining pawl.

P.M.B.X., 65-Line. The connexion of the cord circuit of a 65-line P.M.B.X. switchboard is shown in Fig. 55. This cord circuit replaces that shown in Fig. 45, whilst the line circuit replaces the one shown in Fig. 46, the connexions shown in Fig. 55 being the latest standard for switchboards of this size.

The main alteration in the circuit is in the method of providing through clearing, which is now given from the cord circuit. So soon as an extension line is extended to an exchange line, relays *A* and *B* operate on the removal of the extension receiver. Relay *S* is also operated from the earth on the bush of the exchange line jack, disconnecting the battery and earth fed to the coil *FR* and closing a holding loop to the exchange through the coil *HR* and *C1*. The operation of relays *A* and *B* causes relay *C* to be operated through contacts **A1** and **B1** in series; **C1** removes the holding loop, leaving the extension telephone in control of the connexion, whilst **C2** locks

relay *C*. Hence, when the receiver at the extension telephone is replaced, the holding loop to the exchange is disconnected and through clearing conditions are given. The relays *A* and *B* are, of course, also indicators associated with the cord circuit for supervisory purposes.

Regarding the keysender, relay *KS* and the connexions shown dotted are added and the leads marked *X* are discon-

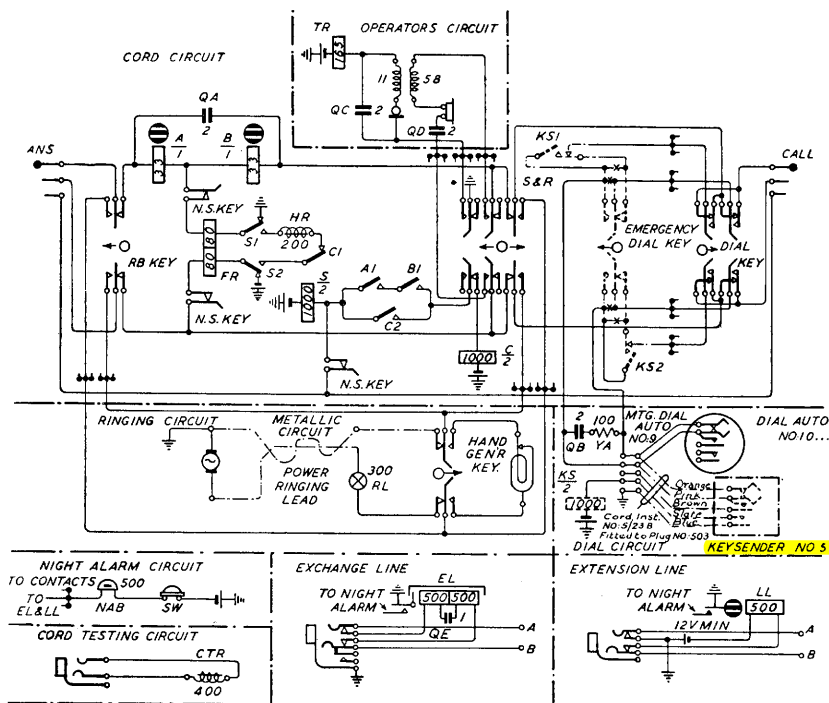


FIG. 55. CORD AND LINE CIRCUITS FOR 65-LINE P.B.X. SWITCHBOARD

nected when this instrument is fitted; the normal dial is, of course, removed. Relay *KS* is operated by the off-normal springs when the keysender moves away from its position of rest; the dial key is, of course, operated, and the contacts of relay *KS* divert the *T* and *R* wires of the calling cord to the impulse springs of the keysender. On completion of pulsing out, relay *KS* is released and this connects the calling and answering sides of the cord circuit, so preventing waiting for the operator to restore the dialling key. The keysender is provided with a

white wheel, carrying black lines, and visible through a window in the top of the instrument. The operator is therefore able to see when the keysender has come to rest, and then restores the dial key, although the circuit has already been connected through by the release of relay *KS*.

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