TELEPHONY

A DETAILED EXPOSITION OF THE TELEPHONE SYSTEM OF THE BRITISH POST OFFICE

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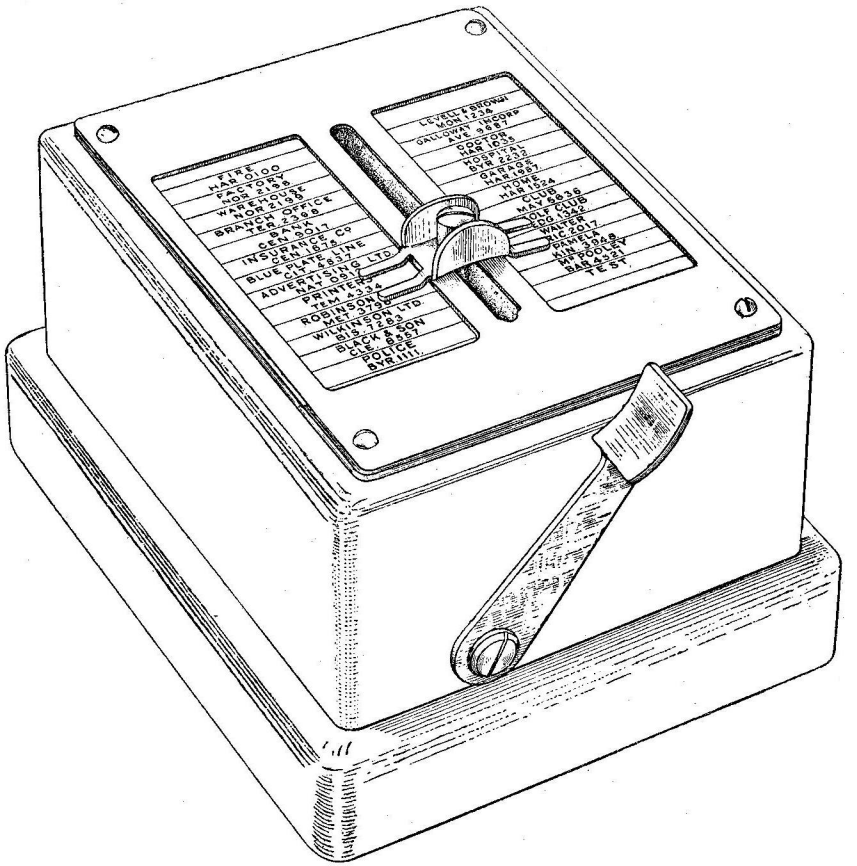

FIG. 47. THE AUTODIAL

The Autodial.(3) Most telephone subscribers have a small circle of business associates and friends with whom they most frequently communicate; with the object of reducing the time spent by the caller in the purely mechanical operation of dialling in such cases, the Autodial has recently been introduced.

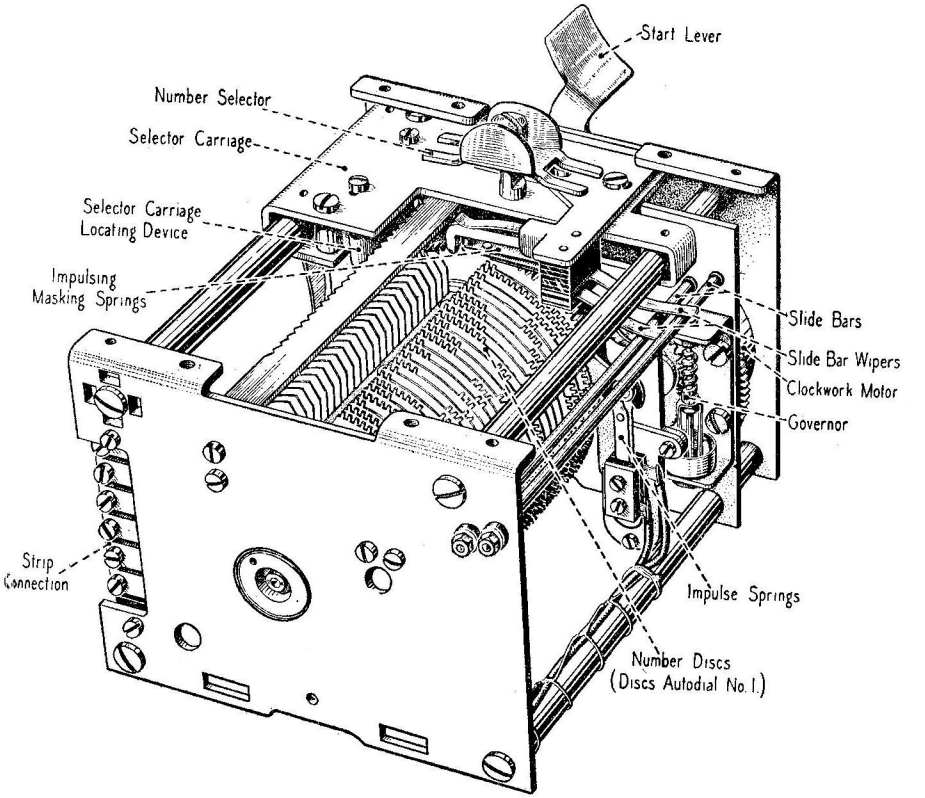

FIG. 48. MECHANISM, SEEN FROM REAR

It is a mechanical sender which can transmit trains of impulses corresponding to 25 or 50 pre-determined numbers, dependent upon the size of the instrument. It is available to subscribers on a rental basis. The smaller size is illustrated in Fig. 47.

The mechanism is contained in a black japanned case having two labels fitted on the top on either side of the slider. In front of the case is a lever which is depressed to provide the motive power for driving the mechanism. To call a number, the name

of the required subscriber is first located by sliding the pointer, which is positioned by a ball click engaging with the notches in the locating rack (Fig. 48). The lever is then depressed and permitted to return. During the return motion, the impulse trains required by the number selected are sent out.

The sending mechanism is controlled by a series of 25 or 50 castellated discs previously prepared in accordance with the numbers of the subscribers whom it is desired to reach. As supplied, the discs have 120 castellations; the disc is prepared for use by cutting out eight teeth between the sets of teeth corresponding to the called subscriber's number; thus, the number 3621 is prepared by leaving one tooth, cutting away eight teeth, leaving two teeth, cutting away eight teeth, leaving six teeth, cutting away eight teeth, leaving three teeth, and cutting away the remainder of the teeth. The cutting is done by means of a special pair of pliers (Tool, Instrument, No. 273). The 25, or 50, sets of discs are then replaced in the instrument in correct order as determined by the label numbering. The purpose of cutting away eight teeth between each digit is to provide for an inter-digit pause of 800 mS.

The prepared discs are seen in position in Figs. 48 and 49.

Turning to Fig. 48, it will be seen that the motive power is provided by a small clockwork motor, the speed of return being controlled by a governor. The selector carriage contains the impulse masking springs which are connected to the wiring through two slide bars and wipers. At the rear of the mechanism (Fig. 49) is the off-normal spring assembly.

The internal connections of the instrument are brought out to a connection strip and are shown in Fig. 50.

Associated with the start lever is a device for centring the drum of discs on its return to normal, to prevent any possibility of the drum coming to rest in a position where the impulsing cam is opening the impulsing springs, as in these circumstances the line would be disconnected.

Having selected the required number, and so placed the impulse masking springs in position against the required disc, the depression of the start lever winds up the clockwork motor. On release, the mechanism is driven round one revolution. So soon as the drum of discs moves away from its normal position, the off-normal springs change over and remain in this position until the revolution has been completed. The impulsing cam is driven round under the control of the governor and standard impulses are generated at the impulse springs. Until the

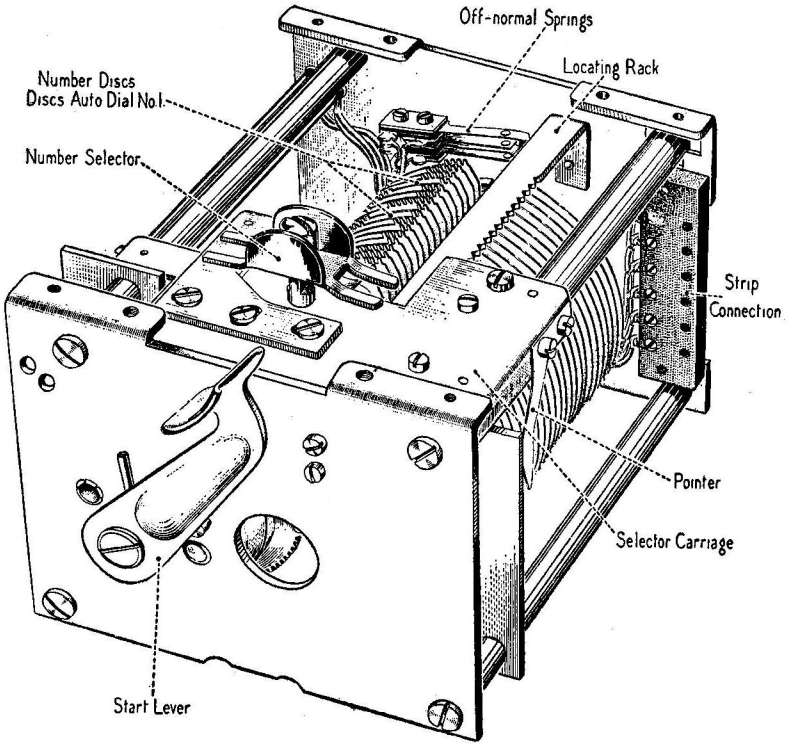

FIG. 49. MECHANISM, SEEN FROM FRONT

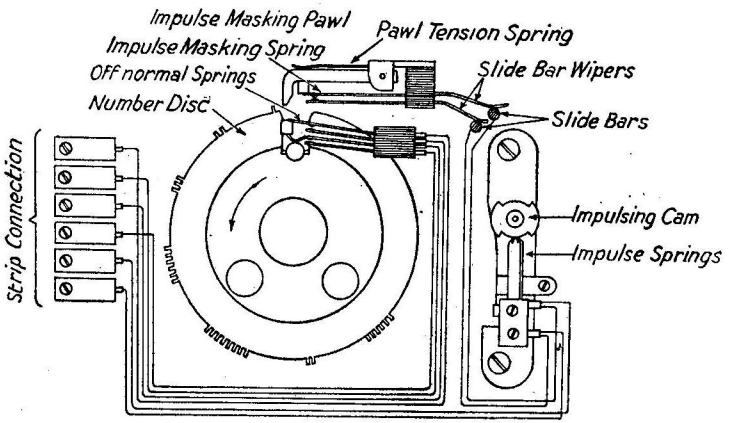

FIG. 50. INTERNAL CONNEXIONS OF AUTODIAL

impulse masking pawl is raised by a tooth or series of teeth, however, the impulse springs are short-circuited by the impulse masking springs and no impulses are sent out. So soon as the masking pawl is raised, this short-circuit is removed. The mechanism is so geared that as each tooth passes the masking pawl, one impulse is sent out from the impulse springs. The masking pawl is so shaped that in passing over the space

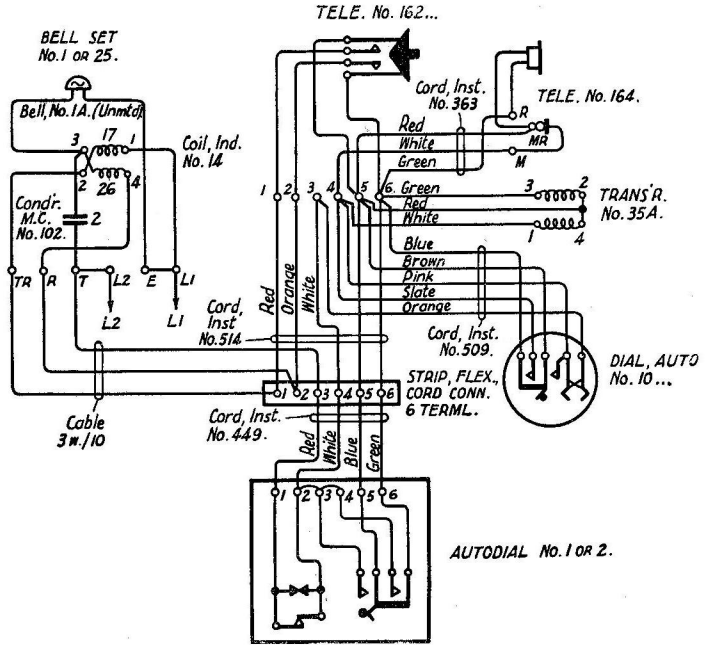

FIG. 51. CONNEXIONS OF AUTODIAL USED WITH HAND MICRO-TELEPHONE

between two consecutive teeth, as in sending out any digit greater than 1, although the pawl moves towards the disc, it does not move far enough to close the masking springs. Thus, the number of impulses corresponding to the number of castellations left on the disc are sent out.

The connexions of the Autodial when used with a hand micro-telephone (Telephone No. 162) are shown in Fig. 51. Calls to subscribers not represented on the Autodial are obtained by using the normal dial associated with the telephone.

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.

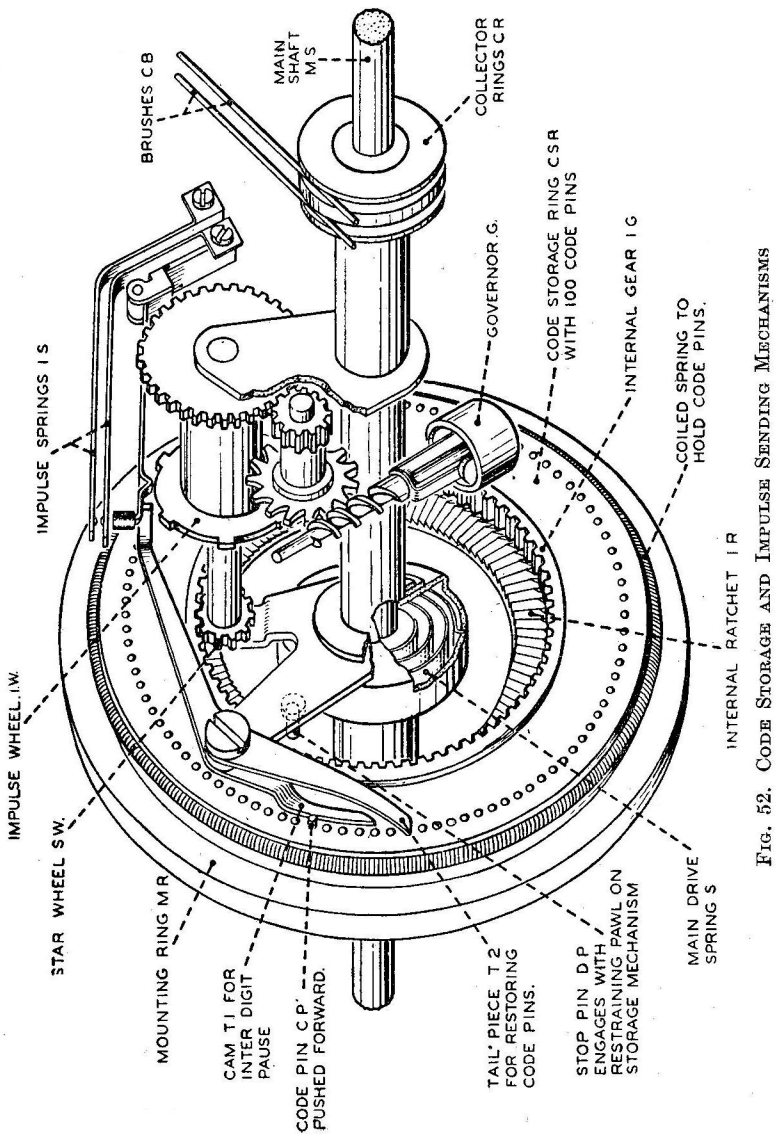

FIG. 52. CODE STORAGE AND IMPULSE SENDING MECHANISMS

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 *RP*1 can be

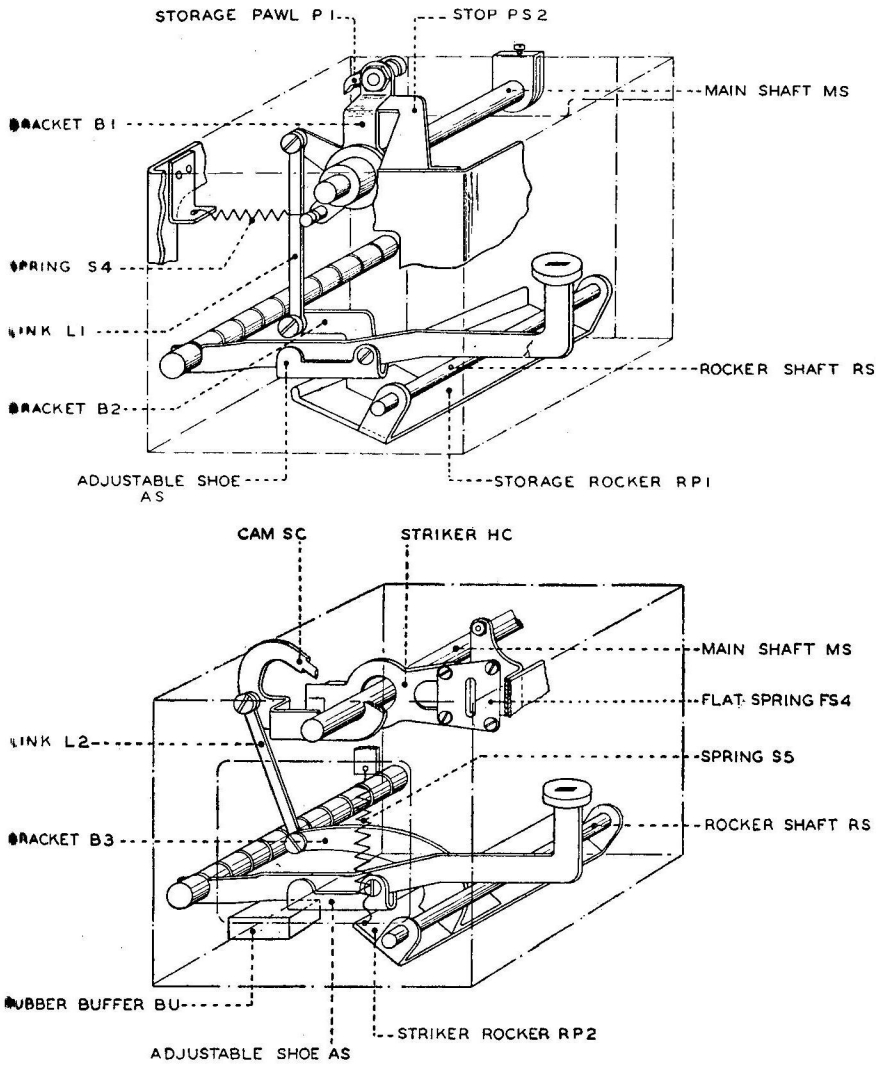

FIG. 53. CODE STORAGE AND STRIKER MECHANISMS

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° 12′, and of 56° 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

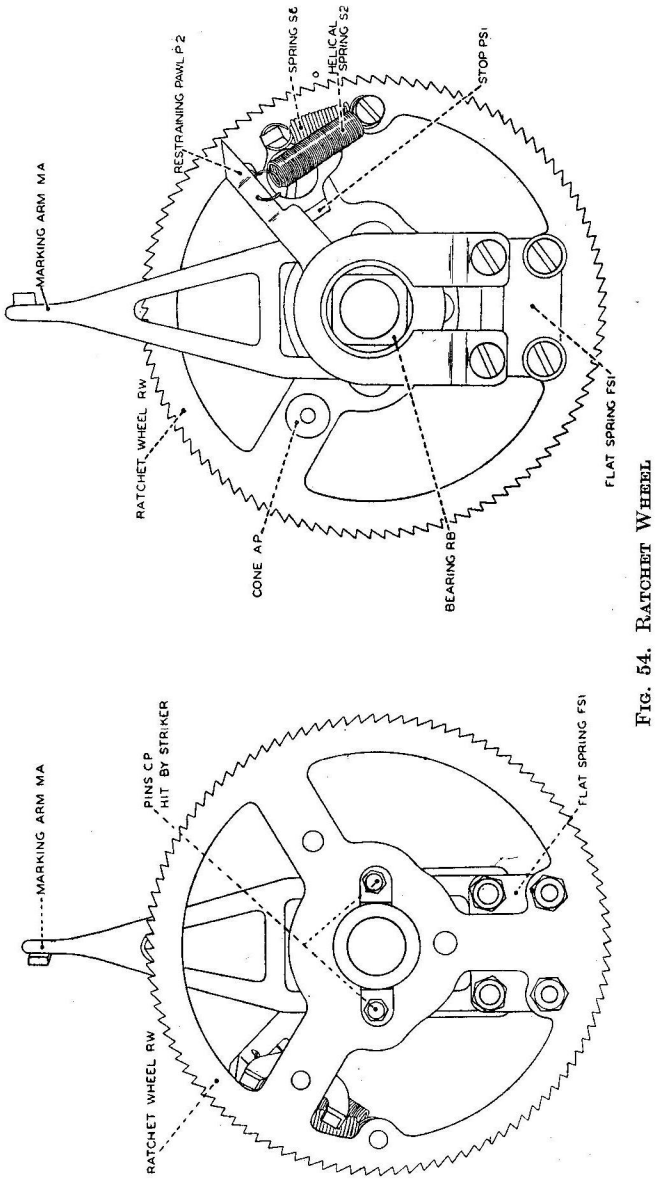

FIG. 54. RATCHET WHEEL

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.