# THE G.E.C. TRIGGER DIAL


**G.E.C. Trigger Dial.**
*Cat. No. DL 1100 series—standard.*
*Cat. No. DL 1200 series—tropical.*

*For many years the Dial Automatic No. 10 has been the standard of the B.P.O. and many Overseas Administrations. The G.E.C. has now produced a new design, with marked advantages in operation and reliability, and immediately interchangeable with the previous standard type on telephones and switchboards.*

*The high standard of performance given by the B.P.O. Dial Auto No. 10, makes the introduction of a new design justifiable only if it offers outstanding advantages in simplicity, accuracy, reliability, and freedom from service troubles.* ***Such advantages are found in the new G.E.C. trigger-type dial.***

THE breaking and re-making of a circuit in which only small powers appear is fundamentally one of the simplest requirements in electrical practice. As the role of the dial in automatic telephone circuits, this requirement loses some of its simplicity as a result of the importance of the timing factor, both in the duration of the make and break periods and in the inter-digit pause. In consequence, the dial becomes a rather complex apparatus on which much effort in design has been expended. Various mechanisms have been introduced to convert the rotation of the fingerplate into movement of the impulse springs at the desired rate, and operation of off-normal springs at the appropriate time. Over-riding considerations have been the need for complete reliability during a long service life, and low cost.

Throughout the world there are several patterns of dials in use, but one in particular has found great favour because it gives the marked advantage that the full inter-digit pause precedes the digit. This is the B.P.O. Dial No. 10, which has been for many years the standard pattern for the B.P.O., and many overseas Administrations.

With the inter-digit pause preceding the digit, the first pause occurs before the first impulse and thus affords a safeguard against premature impulsing when a subscriber fails to wait for dial tone. With dials in which the pause period follows the digits, there is no such initial pause, and the risk of wrong numbers, leading to the needless congestion of switchgear common to all subscribers, is increased.

## Features

Inter-digit pause *precedes* the digit.
Longer inter-digit pause.
Articulated trigger action, eliminating slipping cam.
No clipped nor additional impulses.
Simplified finger-stop with reduced possibility of fouling should the finger-plate be accidentally distorted.
Efficient governor mechanism, including fabric Bakelite worm-wheel.
Still-quieter action.
Impulse ratio unaffected by wear.
Improved dust exclusion from front, dust cover at rear if required.
Sealing of rear cover if required.
Fully effective electrical connexions for dial cord.
Stainless-steel finger-plate.
Minimum maintenance.
Interchangeable with B.P.O. standards.

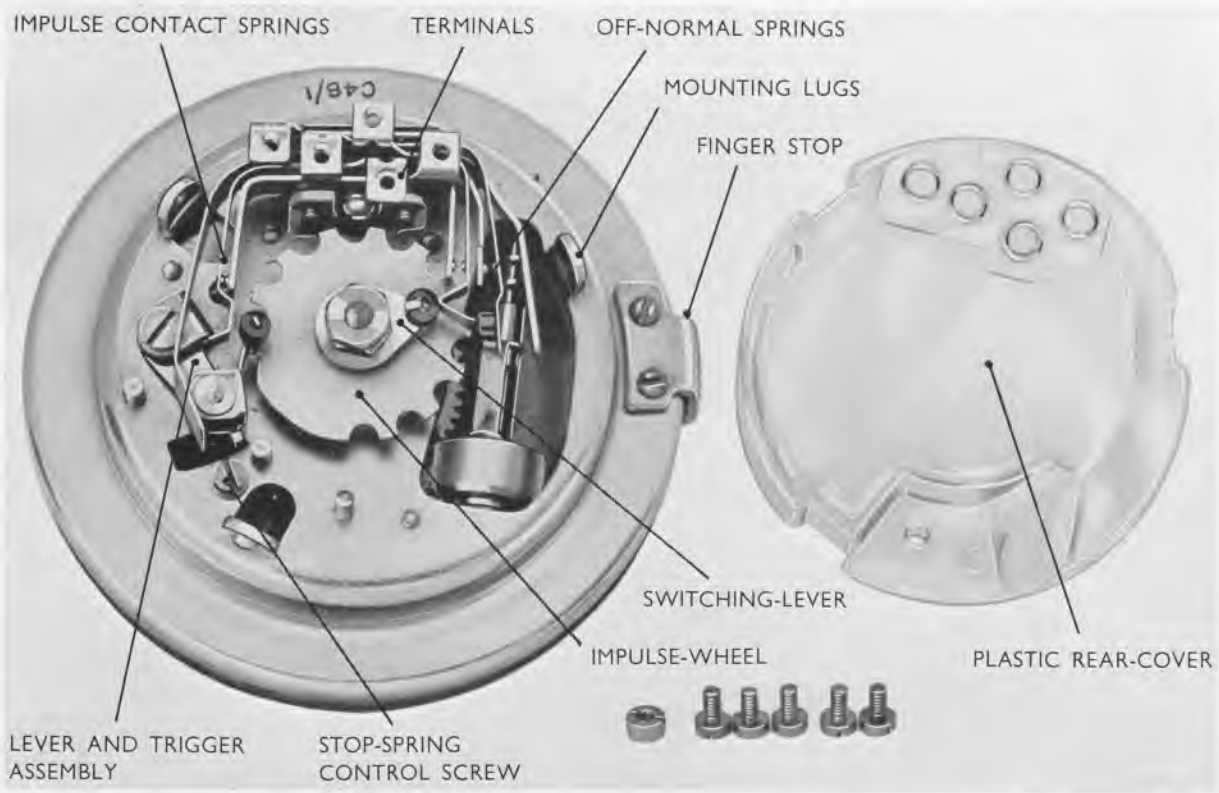



**Fig. 1.—Rear view of Dial—with components identified.**

## Action

A trigger-type action, in which a pivoted arm is actuated by the teeth on an impulse wheel, is fundamentally simple and is likely to be the first idea that occurs to a designer. It did so occur in fact, many years ago. The design, however, could not place the pause before the first digit. To obtain this valuable feature of dial operation, the slipping cam mechanism of the Dial No. 10 was developed. In this, as is well known, a cam masks the impulse-wheel teeth during an initial part of the return motion, and is then held stationary whilst the impulse wheel slips past in the continuation of its rotation to produce impulses. A tendency for the cam to stick instead of slipping, aggravated by dust and moisture, threatened the popularity of the dial until some years ago when four hard steel washers were added to the assembly (G.E.C. Patent) to give a clutch-like action, permitting cam and wheel to rotate together on the forward motion, but to slip on the return. This simple addition reduced very considerably the tendency to false operation and undoubtedly maintained the Dial No. 10 in its position of the preferred design. The slipping cam, however, was always regarded as a feature to be discarded as soon as a better way of producing the same effect could be devised. The new trigger dial achieves this effect by a simple and positive action in which there is no practical possibility of failure.

Illustrated in Fig. 1 are the respective positions of the spring-set assembly, the impulse wheel, the switching lever and the trigger assembly

The trigger, which is made of stainless steel, is hinged on a swinging lever, and is allowed to swing away from the impulse wheel during the winding-up operation of the dial. By the use of this construction, usually referred to as "articulated", the inter-digit pause takes place at the point of greatest advantage, that is, before impulsing commences.

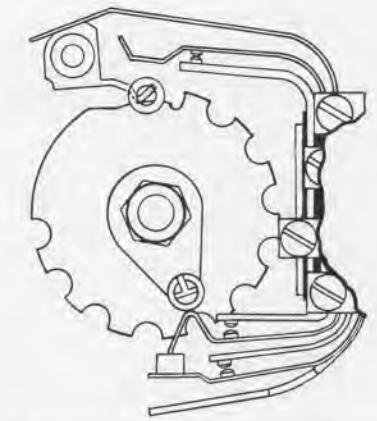
During the forward motion of the finger-plate, the impulse wheel, attached to the finger-plate, rotates and transfers the trigger to the articulated

position (Fig. 2b), so removing any possible danger of the trigger "jamming" in the impulse wheel. Also during this motion, the switching lever moves away from the off-normal springs, allowing the two springs to make contact. As the finger-plate is rotated, a small clock-spring is wound up to store the motive power required to return the dial mechanism to normal.

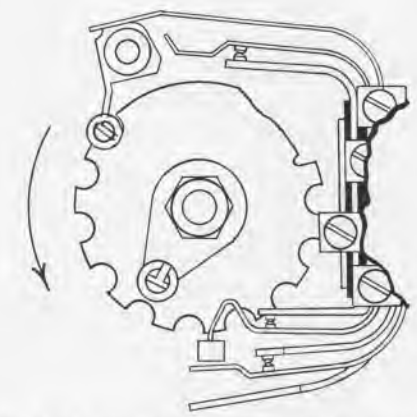
When the finger-plate is released, the impulse wheel, rotating in a clockwise direction, "picks-up" the trigger and transfers it to the impulsing position (Fig. 2c). The time taken for the trigger to move from the articulated position to the impulsing position provides the pause before impulsing commences. The trigger now rides over the first tooth of the impulse wheel to permit the moving spring of the impulse springset to break contact with the fixed spring as shown in Fig. 2c. The continued rotation of the impulse wheel causes the impulsing contacts to be broken and re-made a number of times corresponding to the digit dialled.

An important advantage gained over the slipping-cam dial by the adoption of this articulated trigger mechanism, is the complete elimination of clipped or additional impulses. With the slipping-cam type of construction, the possibility of clipped or additional impulses being given is an inherent defect. An additional impulse can be caused by "over-shooting" of the finger-plate during the actual dialling operation. Over-shooting, *i.e.*, the finger-hole moving too far in relation to the finger-stop, may occur when a pencil is used instead of the fore-finger to rotate the finger-plate. The pencil, if held at an angle, could push the leading edge of the finger-hole under the finger-stop, thus incorrectly positioning the cam on the impulse wheel. The effect of this may be to produce an additional short impulse when the finger-plate is released.

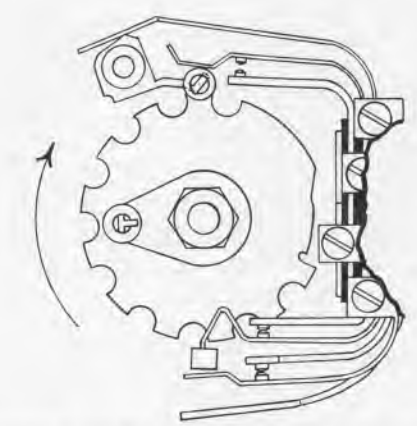
A clipped impulse may occur on the cam-type dial by careless operation. If the leading edge of the finger-hole, corresponding to the digit required, fails to reach the finger-stop, the distance between the edge of the mask plate and the first tooth on the impulse wheel is consequently shortened, with the result that a clipped impulse is given.



(a) Normal position ; trigger lying under impulse springs.



(b) Articulated position ; trigger moved by impulse wheel away from impulse springs ; off-normal springs actuated.



(c) Impulsing position ; trigger moved into engagement with impulse springs.

**Fig. 2.—Action of impulsing mechanism.**

With the G.E.C. trigger dial less precise dialling is required, since it cannot give a clipped nor an additional impulse. If the finger-plate is moved too far or too little in relation to the finger-stop, the trigger rides on to the upper edge of the following or preceding tooth of the impulse wheel. On the release of the dial the trigger then falls back into the groove corresponding to the digit dialled.

The outcome of this improvement has enabled the finger-stop on the trigger dial to be simplified, and, by this simplification, the liability of the finger-plate to be accidentally distorted and foul the finger-stop has been reduced.

A second important advantage gained over the slipping-cam dial is the lengthening of the inter-digit pause. This increase gives the new dial an inter-digit pause greater than that provided by any other dial now manufactured. The lengthening of the inter-digit pause has been achieved by reducing the width of the finger-stop—a modification made possible by the elimination of clipped or additional impulses—thus allowing the finger-plate and consequently the impulse wheel to travel further during the winding-up operation of the dial. Therefore, the extra distance the finger-plate and impulse wheel have to travel in the return motion of the dial, before the first impulse is given, provides the increase in the pause period.

This addition to the inter-digit pause increases the safety margin against calls lost by an impatient subscriber dialling without first waiting for dial tone, and secondly, allows the dial more time to reach full and steady running speed before impulsing commences.

A view of the driving mechanism is shown in Fig. 3. The stop-spring, which serves to keep the main return-spring in a partially-wound position and also to prevent the continued rotation of the finger-plate, is adjusted from the rear of the dial. The object of this new design is to prevent the release of the main spring by an unauthorised person. This may be accomplished on the standard dial by unscrewing the stop-screw fitted under the instruction label at the front of the dial.

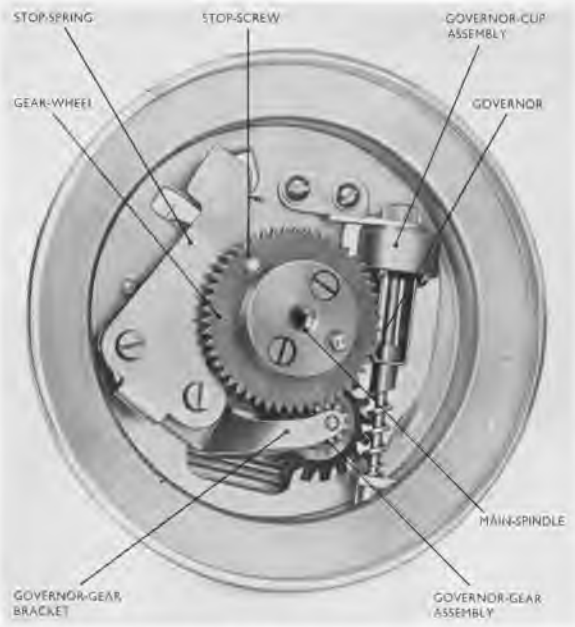



**Fig. 3.—Driving mechanism.**

The speed of rotation on the return motion is controlled by a governor similar to that of the Dial No. 10. A gear wheel fixed to the main spindle is in mesh with a small pinion, on the spindle of which is a worm wheel engaging with the worm of the centrifugal governor. Coupling of the pinion and worm wheel is not rigid but is made through a small spiral-spring clutch which, on the return of the finger-plate, locks the two members together and brings the governor into action. When the finger-plate is rotated by hand to the finger-stop, the clutch is inoperative and although there is sufficient coupling to cause the governor to rotate, pressure on it is relieved and wear consequently minimised. Furthermore, the greater the force with which the finger-plate is rotated by hand the greater is the slip.

The distinctive tooth profile of the worm wheel, designed originally for the Dial No. 10, produces true action of the governor mechanism. Each tooth is undercut so that the leading face is not radial but is very slightly offset. When meshing, therefore, with the worm, the whole face is not in contact, thus preventing the formation of a ridge, which, produced by wear when teeth are of the normal

**Fig. 4.—Rear view—assembled dial, with transparent plastic cover.**

type, gives rise to the tendency to stick. The adoption in the new dial of a worm wheel made of fabric bakelite, a material of great strength and wear-resisting properties, further reduces the possibility of sticking and wear upon the governor.

Noise in the standard dial is mainly caused by vibration of the worm-wheel drive and the governor assembly, and is greatly amplified by the number plate, which, being in metallic contact with the main body of the dial, acts as a sounding-board.

In the new dial the noise generated by the worm-wheel drive has been considerably reduced by the use of the fabric bakelite worm-wheel. In addition, a further reduction in noise has been achieved by the inclusion of a rubber damping-ring fitted under the number plate to minimise the sounding-board effect.

A certain amount of wear is inevitable in any type of mechanism, but in the trigger dial, wear in the moving parts does not upset the impulse ratio. Any wear that might develop on the V-shaped tip of the trigger lever is compensated by wear on the impulsing contacts. Wear on the lever tip would increase the gap between the operating bush and the impulsing spring, but this is offset by the lowering of the impulse spring by wear on the impulsing contacts. Dials after testing to a million trains of impulses show no appreciable variation in impulse ratio.

One of the major enemies of efficient dial operation is dust, which, entering from either the front or rear, accelerates wear, the development of noise and the possibility of losing calls due to dirty contacts. On the new dial the number-plate has been designed to fit closely round the main spindle to prevent dust entering from the front. A transparent moulded plastic cover is available for fitting to the rear of the dial, which not only prevents the ingress of dust but also prevents accidental fouling of the dial cord with the mechanism (Fig. 4).

The holes in the plastic cover, through which connexion to the springset terminals is made, are metal bushed. The metal bushes provide a metallic connexion between the ends of the dial cord and the spring set terminals in addition to that given by the terminal fixing screws. If required, the cover may be sealed to prevent interference by an unauthorised person. By providing a slightly longer cover-fixing screw, with a hole drilled above the fixing nut, a wire thread may be inserted, to the ends of which a seal may be attached.

The new dial has dimensions identical with those of the B.P.O. Dial No. 10, and is designed to fit the three-point mounting found in all standard-type telephones throughout the world.

For the finger-plate, stainless steel is again used, for its strength, light weight and permanence of bright finish.

Maintenance of the dial has been reduced to a minimum, and is chiefly concerned with the simple re-adjustment of spring tensions, contact pressures and contact springs to maintain the dial in correct working order.

Until the advent of this new dial, all means of preventing free calls being made from coin box or call office telephones by dial manipulation have failed. The new dial, by the addition of simple mechanical devices, renders all known methods of making a free call ineffective.