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THE POST OFFICE ELECTRICAL ENGINEERS' JOURNAL

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The Autodial

W. A. COLLETT

Introduction.

NOTWITHSTANDING the very extensive telephone network and the tremendous volume of traffic carried, the telephone communications of the average subscriber are in the main limited to a comparatively small "circle" with whom his business and private interests are mostly concerned. Telephone communication with other subscribers outside this circle constitute a small proportion of the total calls made. It will be found that in a large majority of cases, the number of other subscribers with whom he is in more or less regular communication does not exceed 25, while with few exceptions 50 will cover nearly all cases. That being so, it becomes readily apparent that the process of dialling subscribers within that small "circle" can be reduced considerably, leaving subscribers outside that "circle" to be obtained by means of the normal dial.

The Autodial has been designed to meet this need. It reduces the process of gaining the attention of another subscriber, in so far as the caller is concerned, to the simple operation of selecting the name of the person required and pressing a lever. Nothing more. The Autodial is at once both a directory and a dial machine.

The Autodial is available in two sizes. The smaller, which is known as Autodial No. 1, has a capacity for 25 numbers and the larger, known as Autodial No. 2, has a capacity for 50 numbers. One number on each type is, however, reserved for test purposes, leaving 24 and 49 numbers, respectively, available to the subscriber.

The external appearance of the Autodial—Fig. 1—is a rectangular black japanned metal box, on the top of which are two labels bearing the names and telephone numbers of the subscribers obtainable. Between the two labels is a sliding pointer, which frames the name and number of the required subscriber. The names printed on the labels will be supplied by the renter and will usually be the colloquial name by which the person or firm is known. The telephone number, by the way, is required only in the case of any particular subscriber who for the

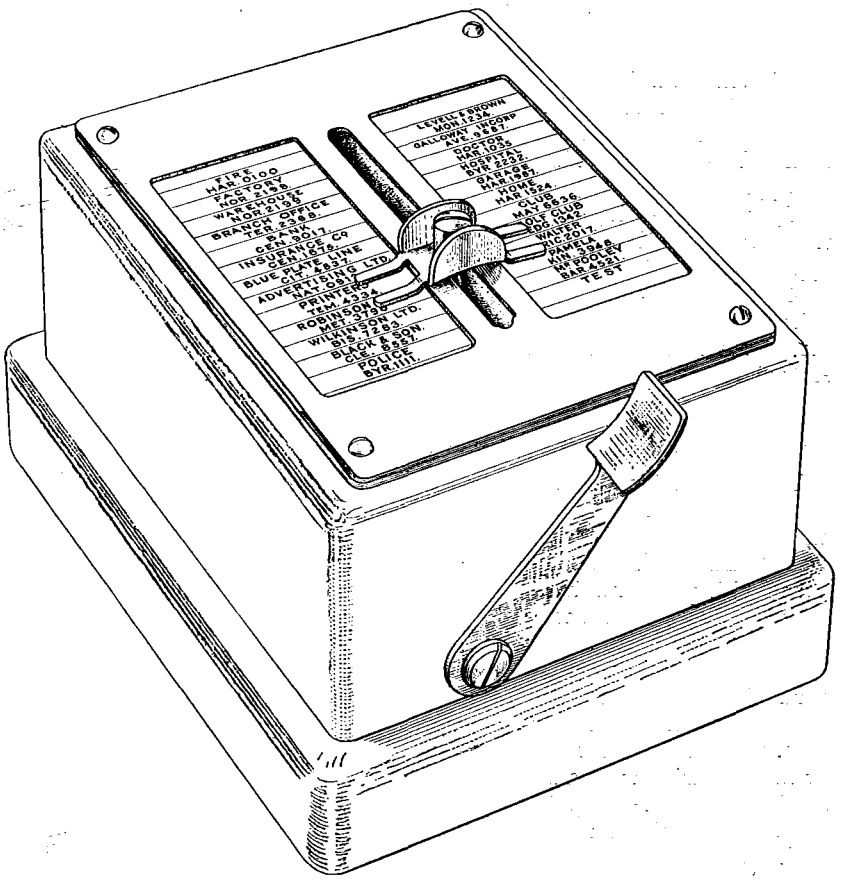

FIG. 1.—THE AUTODIAL.

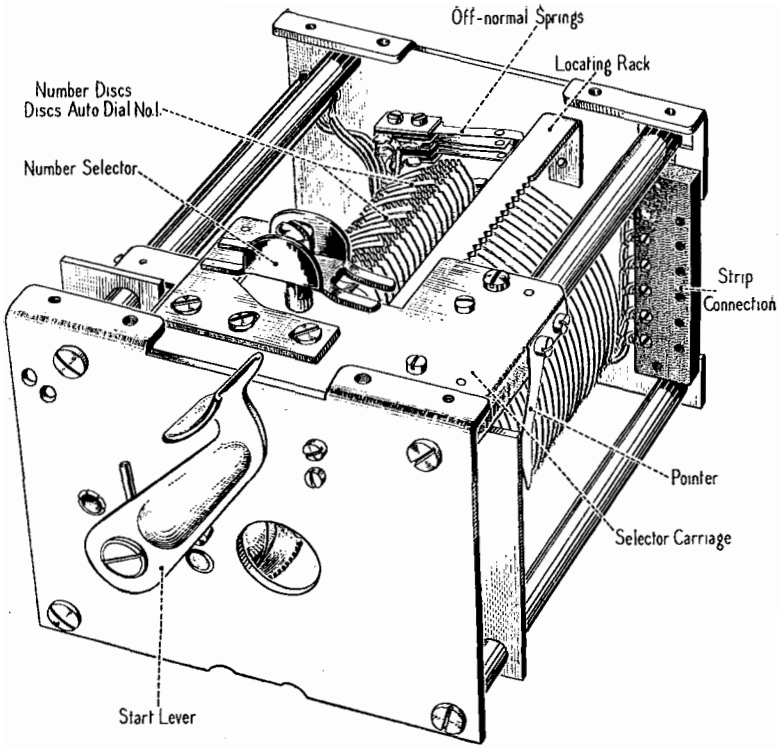

FIG. 2.—MECHANISM, VIEWED FROM FRONT.

time being might be on interception service and for the guidance of the faultsman. The Autodial No. 1 is approximately 7″ long × 5½″ wide × 4″ high, and the Autodial No. 2 is approximately 10″ × 5½″ × 4″.

Two views of the complete mechanism of the Autodial are shown in Figs. 2 and 3.

The Number Discs.

The Autodial consists of a number, 25 or 50, as the case may be, of castellated discs. Each disc is prepared with what might be termed a code corresponding with the trains of impulses necessary to call a particular subscriber. The function of the disc is to control the impulses set up by the impulsing mechanism so that only the impulses necessary for the particular digits making up the called subscriber's number are transmitted to the line. The disc may therefore be regarded as taking the place of the impulse wheel on the normal dial. The disc, however, is capable of controlling the complete number of trains of digits necessary for the various systems of automatic working, Unit Auto, Non-Director, with a maximum of seven trains for the Director System. In addition, the disc provides for the necessary inter-digit pause between each train of impulses.

The disc, which is known as Disc Autodial No. 1, is used in both Autodial No. 1 and No. 2.

The disc as issued has 120 castellations or teeth. Each castellation may be regarded as representing an impulse. In preparing the disc therefore, the object is to cut away all the teeth excepting where it is required to transmit an impulse to the line.

The disc is prepared by means of Tool Instrument No. 273 and the manner of doing so is illustrated in Fig. 4. The disc is inserted in the Tool Instrument No. 273 in the manner shown and it will be observed that the disc retaining spring is uppermost.

Commencing from the slot, the disc is rotated in a clockwise direction and the first four teeth are cut off. This is

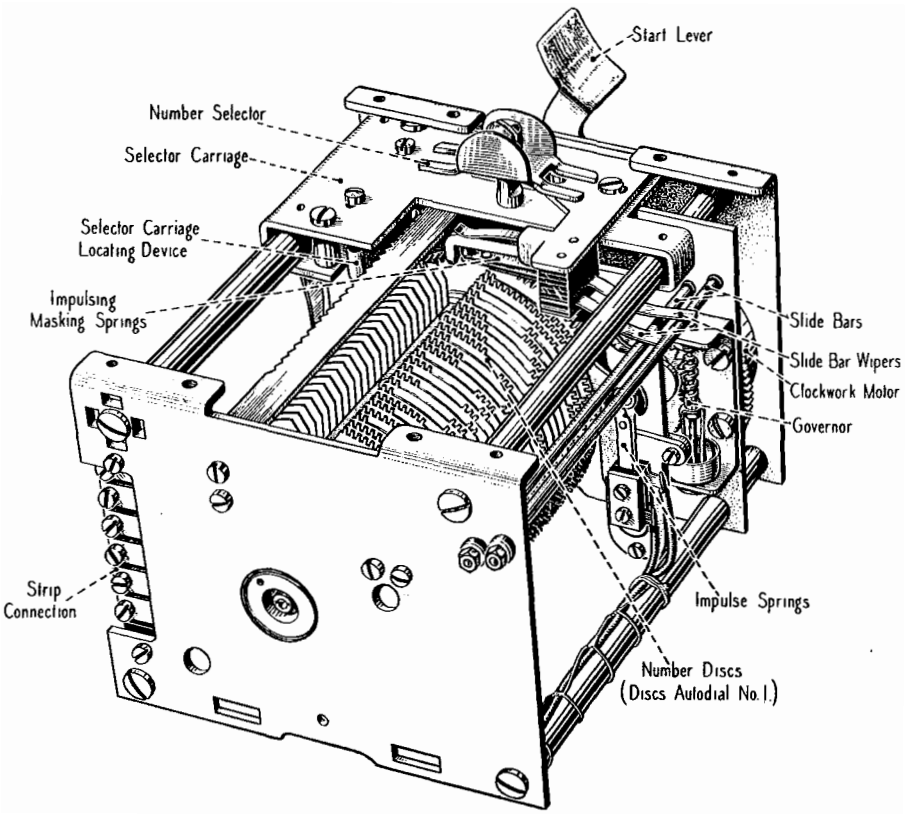

FIG. 3.—MECHANISM, VIEWED FROM REAR.

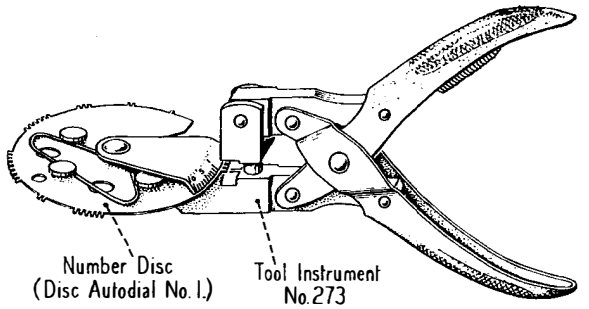

FIG. 4.—METHOD OF PREPARING THE NUMBER DISC.

necessary in all cases, irrespective of the telephone number, to ensure that the off-normal springs adequately guard against clicks throughout the range of adjustment of the impulse-masking springs.

Proceeding to cut the number, the disc is rotated until the first tooth past the cut stands opposite the number on the gauge corresponding to the last digit. If, for instance, the number NAT. 6321 is to be cut off, then the first tooth will stand against the numeral 1 on the gauge. By operating the " Tool, Instrument No. 273," eight teeth are then cut off the disc, forming an inter-digit pause of 800 milliseconds. The disc is then rotated until the first tooth past the cut stands against the numeral on the gauge corresponding to the last digit but one—in the telephone number taken as an example, this will be the numeral 2—and a second series of eight teeth are cut off forming the second inter-digit pause. The remaining digits are set up in a similar manner proceeding always from the last digit backwards in the correct order, to the first digit and an inter-digit pause of 800 milliseconds being cut out between each.

All the teeth remaining after the last digit has been cut, should be cut off. The finished disc will present the appearance of a toothed wheel having a series of sets of teeth. Each set of teeth will be separated by a space equivalent to eight teeth where the teeth have been cut off and the number of teeth in each set will be equivalent to the number of the digit it is required to dial. The illustration shows the telephone number NAT 6321 already set up and the unwanted teeth at the end being cut off.

It will be observed in practice that a short length of each tooth remains after cutting. This is in order and has been allowed for in design. It would require a much more powerful tool than Tool Instrument No. 273 to cut off the teeth clean at the base. Nevertheless, it is extremely important that the tool should cut off as much of the teeth as is possible, otherwise dialling difficulties are likely to arise.

The disc used for test purposes is prepared in the following manner. Commencing from the slot and rotating the disc in a clockwise direction cut out 10 teeth, leave 10 teeth, cut out 40 teeth, leave 10 teeth, cut out 40 teeth, leaving the remaining 10 teeth. This disc will therefore send out three trains of 10 impulses with a pause of 4 seconds between each of them.

The whole of the discs are carried on a common spindle which is coupled through a train of reduction gears to a clockwork motor.

The Clockwork Motor and Control Mechanism.

The clockwork mechanism is controlled by means of a lever, termed the Start Lever, situated on the front of the Autodial. This lever has two functions. In the first place, depression of the lever to its fullest extent further tensions the main spring of the clockwork motor (which is already partly wound up) equal to the tension lost in driving the drum of discs one revolution.

The second function of the start lever is illustrated in Fig. 5. As the lever is depressed, it rotates an

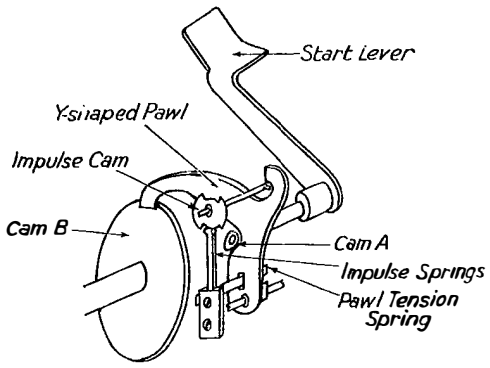

FIG. 5.—CONTROL MECHANISM.

eccentric cam A on the opposite end of the main spindle. This eccentric cam operates a Y-shaped pawl. In its normal position one arm of this pawl engages in a slot in the cam B on the drum of discs, so preventing the drum rotating. The other arm engages a pin on the impulsing cam spindle.

The purpose of this engagement is to ensure that when the drum of discs comes to rest after dialling, the impulsing cam will be definitely stopped in the position in which the impulse springs make contact. Reference to the circuit explanatory diagram, Fig. 6, will show that if this were otherwise, the line would be disconnected.

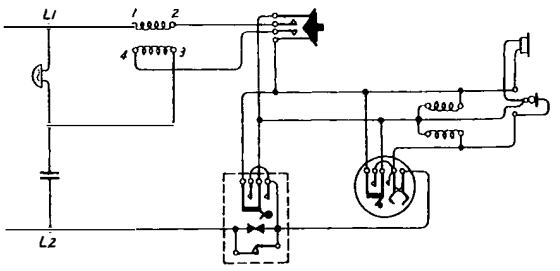

FIG. 6.—CONNEXION OF AUTODIAL WHEN USED WITH HANDMICROTELEPHONE.

The Y-shaped pawl is normally maintained in position under tension provided by a light spring mounted on the impulsing spring bank.

When the start lever is fully depressed, the eccentric cam A lifts the Y-shaped pawl clear of the

slot in cam B and upon the release of the start lever the drum of discs is free to rotate. At the same time, the other arm of the Y-shaped pawl lifts clear of the pin on the impulsing cam spindle and the impulsing cam is also free to rotate.

During the rotation of the discs, the Y-shaped pawl rides on cam B and is so kept out of engagement.

When the drum of discs has made one complete revolution, the Y-shaped pawl falls into the slot on cam B and further rotation of the discs is stopped. At the same time, the other arm of the Y-shaped pawl locks the impulsing cam.

The start lever returns to its normal position during the rotation of the discs, and must not be retarded or interfered with in any way during this return. If it be interfered with, the speed of the rotating discs is varied and the dialling impulses will be mutilated. The start lever must return to its normal position freely and unaided. The design of the start lever mechanism so that the clockwork motor is released only after the start lever has been fully depressed, obviates two difficulties. In the first place, it will be realized that the main spring of the clockwork motor must always be kept nearly fully wound up, in order to maintain a relatively constant speed. If the clockwork motor could be released after the start lever had been only partly depressed, then, as the drum of discs must make one complete revolution, the condition would arise where more tension was taken out of the main spring than was put in. Consequently after a few such operations the clockwork motor would be completely unwound, in all probability coming to rest with the drum of discs left in a position other than normal. Moreover for a number of operations before the clockwork motor had become completely unwound, the speed would have been so much reduced as seriously to mutilate the impulses and render them useless.

The second difficulty which has been obviated by the design adopted is that of over-winding. It will be appreciated that with operations each resulting in a little over-winding, the condition would eventually arise where the main spring would refuse to be wound up any more, (apart from the risk of breakage) and the mechanism would lock. Release of the mechanism could then be effected only by taking the mechanism out of the case and releasing the retaining pawl.

The speed of the Autodial is governed by a governor similar to that on the normal dial and is such that the standard impulsing speed of 10 impulses per second is maintained. The method of adjustment of the governor on the Autodial is similar to that for the governor on the normal dial, the governor springs being bent inwards to increase speed and outwards to decrease speed. One difference will be observed on inspection of the Autodial governor, that is, the governor springs are set slightly inward, whereas in the normal dial correctly adjusted for speed, the governor springs are roughly parallel. The setting inward of the governor springs on the Autodial is in order that the inertia of the mass of discs may be more quickly overcome and correct speed reached as soon as possible.

The Impulsing Spring Assembly. Fig. **7.**

A butterfly cam of insulating material continuously rotating between two contact springs is employed in this device. The butterfly cam rotates at 5 revolutions per second, providing in that time 10 complete

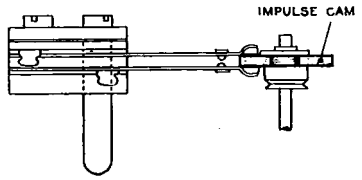

FIG. 7.—IMPULSE SPRING ASSEMBLY.

cycles of break and make of the impulse contact springs. The cutting of the butterfly cam is such as to provide the standard break to make ratio of 66 and 33 milli-secs. respectively.

The Impulse Masking Spring Assembly. Figs. **8** and **9.**

The impulse masking springs are controlled by the impulse masking pawl. Tension is applied to the impulse masking pawl by the pawl tension spring.

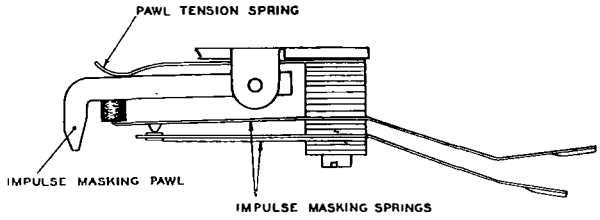

FIG. 8.—IMPULSE MASKING SPRINGS.

The impulse masking contact springs are extended in the form of wipers travelling over the wiper bars which are in turn wired in parallel with the impulsing springs. The impulse masking contact springs are

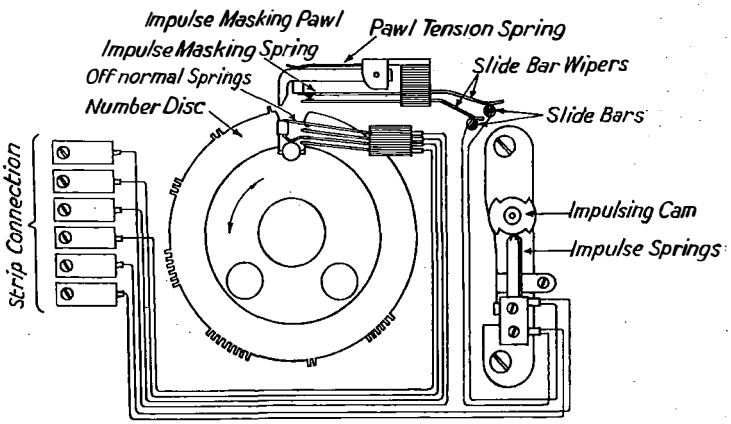

FIG. 9.—ELECTRICAL CONNEXIONS OF AUTODIAL.

normally making and they also make when those portions of the number disc where the teeth have been cut away are passing the impulse masking pawl. When the impulse masking pawl is riding on a castellation on a number disc, the contact springs are opened and the phase relationship between these springs and the impulsing springs is arranged so that the latter are open at the same time. By the special shaping of the impulse masking pawl, it is arranged that, when a slot between two consecutive castellations on a number disc forming part of a digit train is passing the impulse masking pawl, although the pawl, in following the contour of the discs, reduces the clearance between the contact springs, they do not make contact.

It will be seen, therefore, that the impulse masking springs short-circuit the impulsing springs at all times excepting during the digit trains as set up on the particular disc selected.

The impulse masking spring assembly is carried on a bracket secured to the number selector.

Provision is made in the method of securing the impulse masking spring assembly to the number selector to provide for adjustment to ensure the correct phase relationship between the impulsing springs and the masking springs previously referred to. Referring to Fig. **10**, it will be seen that the

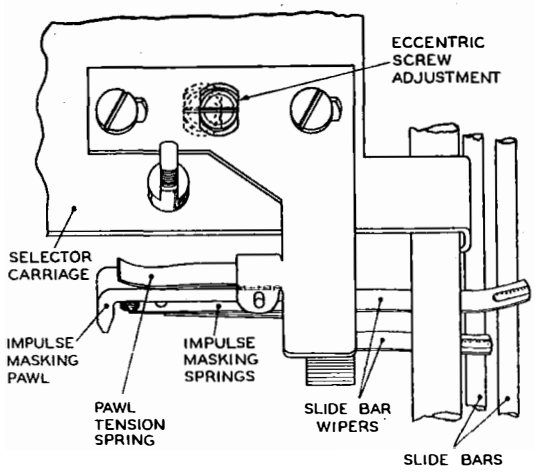

FIG. 10.—NUMBER SELECTOR.

bracket carrying the impulse masking spring assembly is secured to the number carriage by two screws through drawn holes. By slacking off the fixing screws and rotating the eccentric screw, the position of the bracket can be varied. This varies the position of the impulse masking pawl in relation to the castellations on the number disc.

When in correct adjustment, the masking springs should break during the closure of the impulse springs prior to the first break of the digit train and remake during the closure of the impulsing springs immediately after the last break of the digit train.

The Number Selector.

The number selector is illustrated in Fig. **10**. It takes the form of a sliding carriage which may be moved longitudinally over the drum of number discs. The number selector carries on its upper side a pointer which frames the name of the wanted subscriber on the label on the top of the Autodial.

Also, as previously described, on this carriage is fitted the impulse masking spring assembly. By moving the pointer on top of the Autodial to the name of the called subscriber, the impulse masking spring assembly is positioned over the corresponding number disc.

Sliding Carriage Locating Device.

Fig. **11** illustrates the method whereby it is ensured that the number carriage will not stay in an inter-

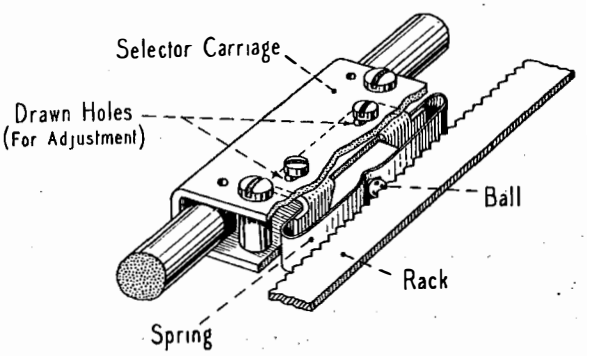

FIG. 11.—SLIDING CARRIAGE LOCATING DEVICE.

mediate position between two discs. A steel ball is held in tension against a rack by means of a flat steel spring. The steel spring should be tensioned sufficiently to ensure that the sliding carriage will not stay in an intermediate position, but not so heavily tensioned as to make movement of the pointer too stiff.

The flat steel spring is mounted on a small angle bracket which, being secured to the sliding carriage by two screws through drawn holes, provides a means of adjustment of the sliding carriage in relation to the rack.

Off-normal Springs Assembly. Fig. **12**.

The off-normal springs serve precisely the same function as those on the normal dial. Normally they

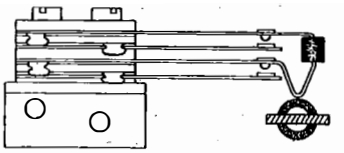

FIG. 12.—OFF-NORMAL SPRING ASSEMBLY.

are resting on an ebonite collet forced on to the end of the number disc locating bar. They operate immediately the Autodial moves off normal and remain operated until the Autodial again comes to rest.