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A LOW-COST TIME ANNOUNCER

H. B. Edwards and T. R. Pecak—Audio and Relay Development Section, Engineering Department

The new Time Announcer described has been designed to satisfy a genuine and recurrent need for a reliable but inexpensive time service sufficiently accurate to meet all normal requirements. The machine uses a magnetic-type recording medium and gives 'time of day' announcements at 10-second intervals when a designated number is dialled. Provision is made for two types of speed control, i.e. synchronous drive for a.c. mains and d.c. pendulum drive for areas where a mains supply is unreliable or not available.

THE use of Time Announcers with telephone systems is now becoming quite common and represents a useful source of revenue to an Administration. The new Time Announcer, or Speaking Clock, has been developed for use where an economically priced equipment is required with a degree of time accuracy sufficient for normal domestic requirements. No attempt has been made to achieve higher time accuracy because of the much higher costs involved in the production of the clock and in its subsequent maintenance.

The Announcer, illustrated in Fig. 1, is simply a recording and reproducing machine with the necessary time announcements stored in it. By driving the machine at the correct speed a series of announcements are generated and, when the designated number for the system is dialled, the appropriate time announcement is amplified through distribution amplifiers and applied to the caller's line. Special anti-crosstalk circuits are included in the connections between subscribers and the amplifier output to prevent conversation across the clock circuit.

The machine is designed primarily for 12-hour repetition but, as will be seen later, provision can be made for 24-hour time with very little change to the mechanism. Time-of-day announcements are recorded and reproduced by standard magnetic recording techniques on a neoprene-surfaced drum, the neoprene being loaded with a magnetic oxide which acts as the recording medium. The time is given at 10-second intervals, since to provide a higher rate of announcement would result in loss of intelligibility and a lower rate would give long silent periods between signals.

Considerations of Accuracy

If a number of messages are recorded on a drum of the type mentioned, and means are provided to reproduce these messages in the order in which they were recorded, it is possible to provide an accurate clock simply by rotating the drum at the required speed. Accuracy of the clock would be determined solely by the drive speed of the drum, the drive being essentially of the non-slip type. To obtain high accuracy of drive as provided by T.I.M. in the B.P.O. system a phonic motor could be used, driven from a stable high frequency oscillator through a series of frequency dividers, but this arrangement would be much too expensive for the type of machine now under discussion and would in any case provide for greater accuracy than is required.

Fortunately, there is a readily available form of stable frequency supply in the a.c. mains. This supply, although subject to short term inaccuracies, is corrected daily during off-peak periods so that the correct number of cycles is supplied in a twenty-four hour period. Thus, by using a synchronous drive, an Announcer will keep correct time for very long periods and be subject only during periods of heavy load to small errors which will be automatically corrected.

This simple and economic arrangement, which ensures a degree of accuracy more than adequate for all practical timekeeping requirements, is used in the a.c. version of the new Time Announcer.

In areas where the mains supply is not so well regulated, another system of speed control is necessary. This is obtained by utilizing the pendulum master clock in the main exchange in conjunction with suitable circuits to provide precise timing pulses to the drive motor. For these installations a d.c. motor is used, powered from the exchange battery.

Both a.c. and d.c. versions of the Announcer are identical except for the driving motors used and the need for the inclusion of a relay-set and timing shaft in the d.c. machine.

The Announcer is a self-contained free-standing unit with approximate overall dimensions 11½″ x 12″ x 13½″ (29 x 30 x 34 cm), and may be placed on a table or wall shelf, or accommodated on a standard equipment rack 19″ or 30″ (48 or 76 cms) wide. The equipment is protected by a dust cover.

THE A.C. TIME ANNOUNCER

Form of Announcement

Announcements are made every ten seconds in the form:

" The time is ten twenty-seven and ten seconds ".

To cover the full twelve-hour period, a total of 4320 messages is required if each announcement is regarded as separate from every other. This recording problem is minimized by sub-dividing the message into four parts as indicated below:

"The time is ——	(Preamble)
——— ten ———	(Hours)
—— twenty-seven ——	(Minutes)
—— and ten seconds."	(Seconds)

Synthesizing the announcement in this manner reduces the number of recorded messages required to 79, this total being composed of the standard preamble, together with 12, 60 and 6 messages for the appropriate hour, minute, and 10-second periods. The word ' o'clock ' is used in the minutes message instead of ' sixty ', and the word ' precisely ' instead of ' and sixty seconds ' in the seconds messages. Announcements at the exact hour and completed minute are then given in the following form:

" The time is ten o'clock precisely."
" The time is ten o'clock and ten seconds."
" The time is ten seventeen precisely."

Each 10-second cycle also includes a silent period during which the stepping and releasing of the heads occurs.

The cycle is divided as follows:—

Preamble	0 to 1·95 secs.
Hours	1·95 to 2·95 secs.
Minutes	2·95 to 4·49 secs.
Seconds	4·49 to 7·19 secs.
Stepping Period	7·19 to 10 secs.

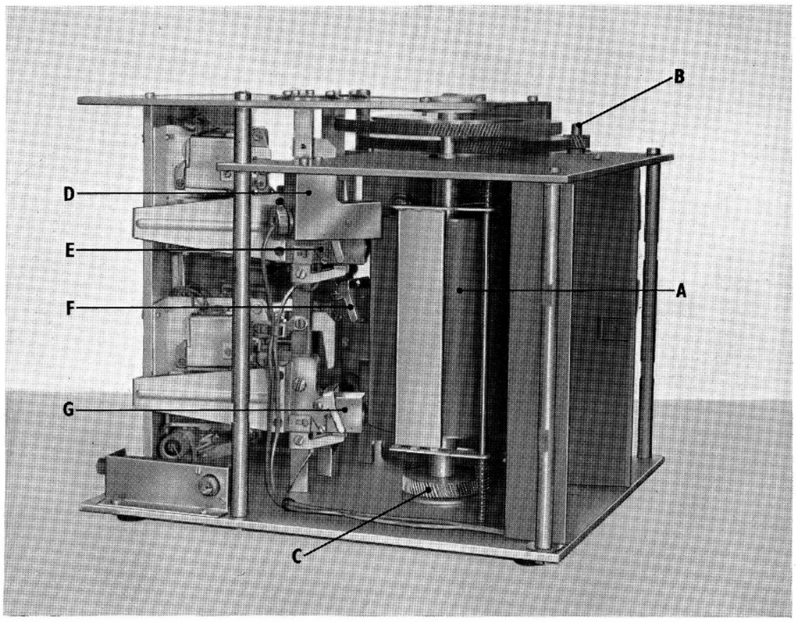

Figure 1—General View of a.c. Time Announcer with dust cover removed

A = Neoprene-surfaced drum.
B = 83⅓: 1 reduction gear train.
C = 3: 1 reduction gear train.
D = Preamble Head.
E = Hours Head.
F = Minutes Head.
G = Seconds Head.

The figures quoted are for an Announcer with recordings in English; some change in the values is usually necessary for recordings in other languages.

Each of these periods is maintained below $3\frac{1}{3}$ seconds, as this is the time taken for one revolution of the magnetic drum and a longer message could not be recorded on one peripheral track. The tracks are individually scanned three times during the 10-second cycle but provision is made to connect each head in turn to the amplifier for only that period allocated to its portion of the message. These connections to the amplifier are made via four springsets operated by cams on a shaft rotating every 10 seconds, the cam dwell-times being so arranged that discontinuities in the announcement are avoided.

ANNOUNCER MECHANISM

The mechanical arrangement of the Announcer may be seen by further reference to Fig. 1.

The drum (A) is driven through a two-stage $83\frac{1}{3}$:1 reduction gear train (B) by a 1500 r.p.m. motor to obtain a drum speed of 18 r.p.m. or $3\frac{1}{3}$ seconds per revolution. By use of an additional reduction gear (C) with a 3:1 ratio, a camshaft at the rear of the drum is arranged to rotate at the required speed of 1 revolution every 10 seconds.

Four reproduce-heads (D, E, F and G) are individually employed for the preamble, hours, minutes, and seconds messages. The preamble-head has a fixed position and reads the same track on the rotating drum continuously, whereas the hours,

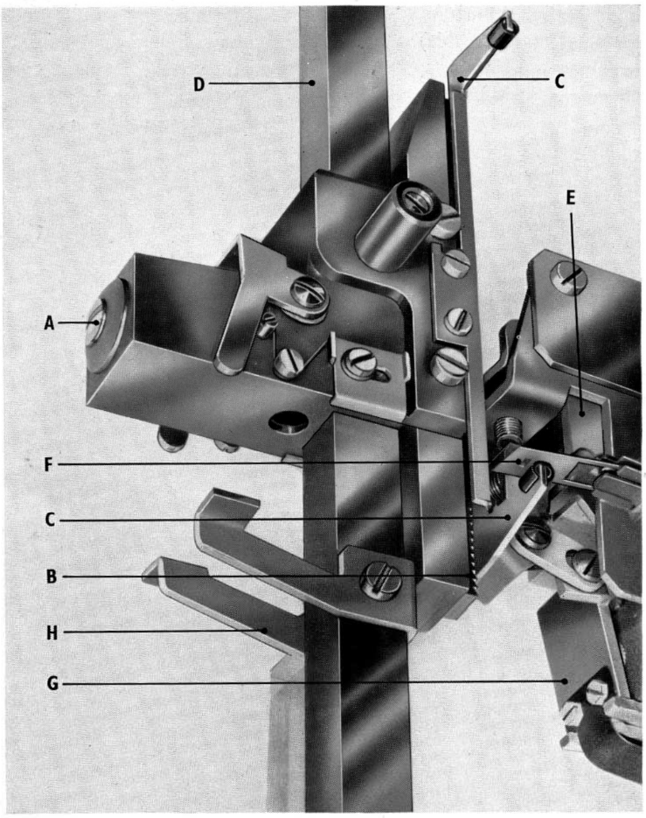

Figure 2—Close-up of minutes-head mechanism

A = **Reproduce Head.**
B = **Vertical Ratchet.**
C = **Extensions of Forked Bracket.**
D = **Shaft.**
E = **Stepping Magnet Frame.**
F = **Toggle Switch.**
G = **Release Magnet Armature.**
H = **Bottom Stop.**

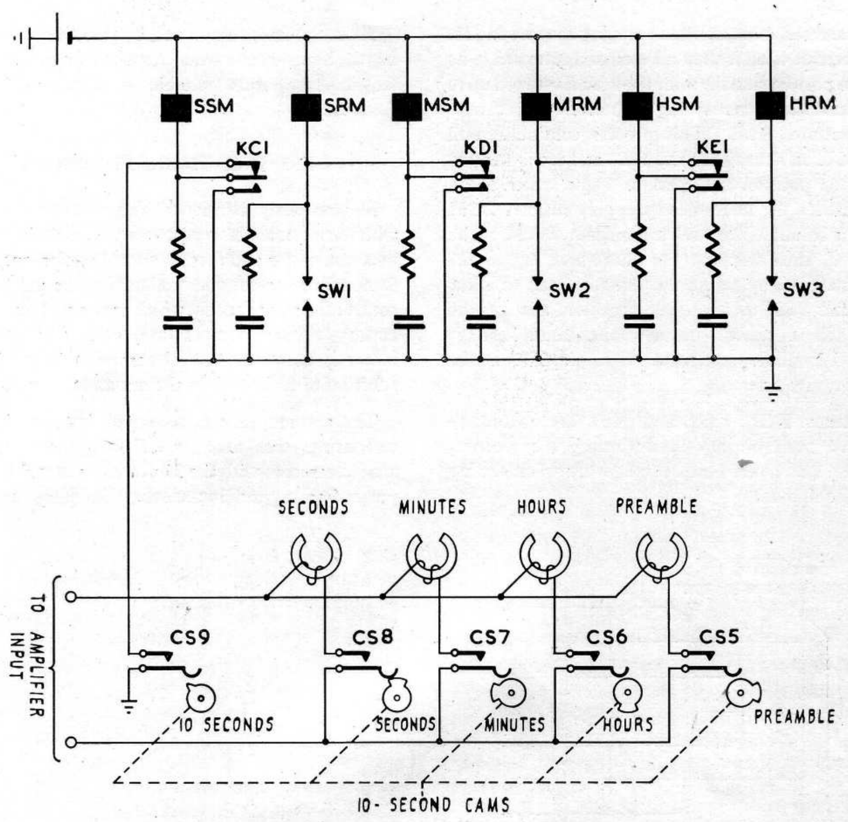

Figure 3—Simplified Schematic for interlocking of recording heads

minutes and seconds heads step over a number of positions and read off twelve, sixty and six messages respectively.

An exploded view of a typical moving-head mechanism is shown in Fig. 2. The reproduce-head assembly consists essentially of the reproduce head (A), a vertical ratchet (B) and a forked bracket with upper and lower extension arms (C). The assembly is mounted on a square vertical shaft (D) arranged parallel to the drum (not shown) and, at regular time intervals, a stepping magnet (E) is operated to cause a pawl to engage with the vertical ratchet and step the head to successive time tracks. After completion of each step the head is maintained in position by a detent pawl.

A toggle switch (F) is fitted to permit electrical interlock with other heads. This switch is mounted on the release-magnet housing and operated by the lower extension arm of the forked bracket when the moving-head assembly is stepped to its highest position. Conversely, when the moving-head assembly is subsequently released by the action of its associated release magnet (G) and returns to its initial starting position (H), the upper arm of the bracket restores the switch.

The heads are electrically interlocked by the circuit shown in Fig. 3. Springset CS9 is operated for a brief period by each revolution of the 10-second shaft and feeds an earth pulse to operate SSM (the seconds-head stepping magnet) via KC1. The seconds-head thus rises one track every ten seconds. When the sixth pulse is received, the head operates the toggle switch SW1 which completes a circuit for the operation of the seconds-head release magnet

SRM and the minutes-head stepping magnet MSM. The seconds-head is thus released and returned to its bottom position and the minutes-head is stepped up to the next track. On reaching the bottom the seconds-head restores SW1. This process continues until the end of an hour, when the minutes-head is stepped to its top position and operates toggle switch SW2. This causes the hours-head stepping magnet HSM and the minutes-head release magnet MRM to be operated, thus stepping the hours-head up to the next track and releasing the minutes-head to allow it to fall back to its lowest position and restore SW2. In a similar manner, the hours-head is released by the operation of HRM via SW3 at the end of twelve hours.

Switches KC1, KD1 and KE1 are manually-operated push buttons used to step the seconds, minutes, and hours-heads respectively when setting up the equipment.

From the foregoing, it will be seen that by increasing the hours-head ratchet steps to 24 and by use of a longer drum, it is possible to provide a 24-hour Announcer.

THE D.C. TIME ANNOUNCER

As previously mentioned, this version is identical with the a.c. machine, except that the drive is supplied by a d.c. motor and that additional equipment, in the form of a relay-set and timing shaft, is provided to control the motor speed, which varies with exchange-battery voltage, temperature, etc. A shunt field motor is used, with speed control obtained by the addition of resistance in the armature circuit.

The accuracy of the d.c. clock is maintained by comparing the time taken for three complete announcements with the 30-seconds interval between pulses from a pendulum clock. The pulses from the

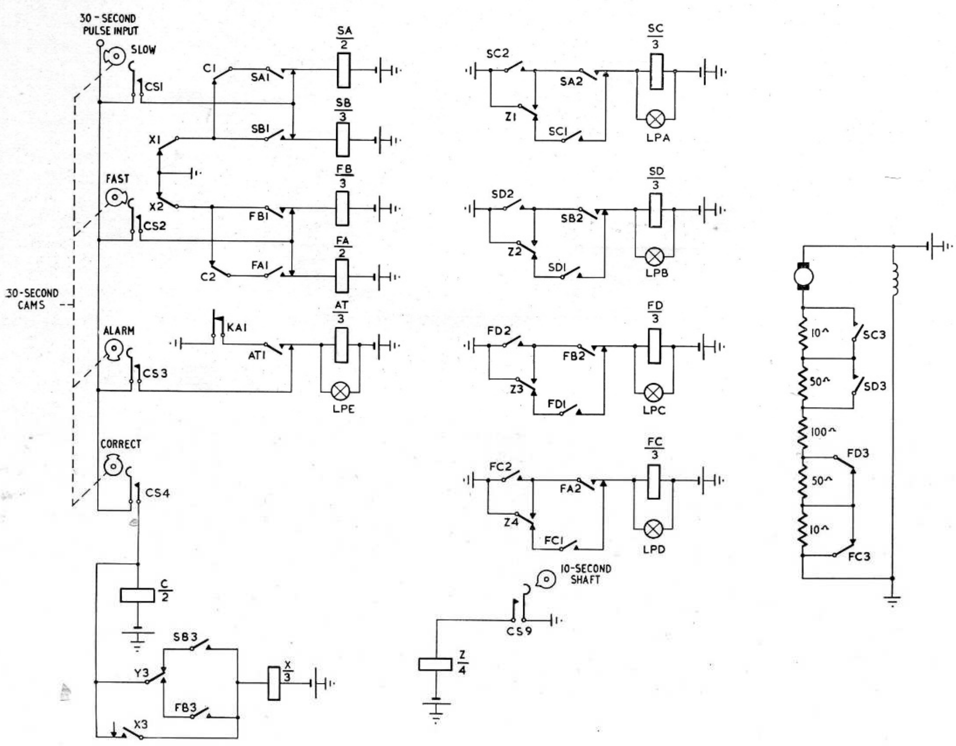

Figure 4—Simplified schematic of time-correction circuit (d.c. version)

pendulum clock are fed into different input points in a relay circuit depending upon whether the machine is running fast, slow or correctly. The relay circuit then changes the resistance in the motor armature circuit to advance or retard the clock in the sense necessary to correct the error.

The additional camshaft fitted to the machine is driven through a 3:1 reduction gear from the 10-seconds shaft to make one revolution per three messages (approximately 30 seconds). Four cams on this shaft operate springsets through which the pulse from the pendulum clock is fed to the various inputs of the relay circuit (see Fig. 4). If the clock is within ±3 seconds of the correct time, the pulse is applied through the 'correct' springset CS4 to operate relay C. If the clock is between 3 seconds and 12 seconds slow, the pulse operates relays SA and SB via 'slow' springset CS1; if between 3 and 12 seconds fast, relays FA and FB operate. Should the clock be more than 12 seconds slow or fast, relay AT operates through the 'alarm' springset CS3, to cause the clock to stop and an audible alarm to sound.

When operated, the 'slow' relays SA and SB apply short circuits across two resistors in series with the armature circuit to increase the motor speed and cause the clock to gain. Further pulses received during subsequent closures of the 'slow' springset have no effect, but as the clock continues to gain, a pulse eventually occurs during the 'correct' period to operate relay C. This releases the SA relay and the short circuit is removed from one of the resistors in the armature circuit and the clock slowed down to approximately the correct speed.

With only SB relay operated the clock may gain or lose. If the latter condition arises, SA relay is operated in due course by a pulse during the slow period, and the same cycle is repeated. On the other hand, if the clock gains to such an extent that it is fast with respect to the pendulum clock, the next pulse operates relay X, thus releasing relay SB and returning the circuit to its original condition.

The operation of the circuit when the clock is running fast is exactly the reverse of the description above, relays FA and FB being used to insert resistance in the armature circuit.

This method of speed control works effectively on the clock since it causes the motor to be run slightly fast for part of the time and slightly slow for the remainder, thus permitting the average correct speed to be obtained. If the battery voltage is high, for example, the relays FA and FB will be operated for most of the time, whereas if the battery voltage is nominal there will only be occasional operation.

The system as described has the disadvantage that the speed of the drive motor is changed at the instant of arrival of the pulse from the pendulum clock. This could occur at any time during an announcement, whether the clock is running slow or fast; the speed change would then be heard as a slight change in the tone of the announcement. To avoid this, the speed change is delayed until the next silent period. The speed control relays SA, SB, FA and FB each have slave relays SC, SD, FC and FD respectively. Operation of the SA relay, for instance, prepares a circuit for the relay SC which only operates when the Z relay is operated at the commencement of the silent period by a cam on the 10-second shaft. Relay SC is used to change the motor speed so that the change is initiated on the arrival of the timing pulse but delayed until the next silent period. Similarly, when the SA relay is released, relay SC remains operated through a contact of the Z relay until the commencement of the next silent period.

Conclusion

The new Time Announcer is an equipment in which elaboration has been deliberately avoided to obtain an economical design, simple in concept, yet capable of providing a degree of accuracy more than adequate for all practical timekeeping requirements. The true value of the Announcer may be assessed, not only by its relatively low cost and ability to provide an accurate time source for the subscriber, but by its earning capacity and the material contribution it makes to the convenience and efficiency of operators burdened with 'time by the exchange clock' announcements.

Source: *Ericsson Bulletin*, July 1962. One of these clocks was used on the island of Jersey (it no longer survives). It was replaced by the Assmann ZAG 500 http://www.bayern-online.com/v2261/artikel.cfm/203/Video-Zeitansageeinrichtung-Deutschland.html in July 1969.

Later, in February 1992, it was transferred to the new Voicemail platform supplied, reportedly, by Motorola. Then onto the mobile Alcatel voicemail platform, probably around 2000. The local TIM service was discontinued in 2009 when it was decided to simply route to the BT (British Telecom) clock.