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between a central station and base stations are effective in solving this problem. However, in the multi-drop system, a construction of transmission line is changed at a point on the line between the central station and the base station and, therefore, when an amount of delay is changed, a phase correction becomes very difficult. That is, although a variation of delay occurred in a portion of the transmission line on the side of the central station does not arise any problem since phases of all of the base stations connected thereto change similarly, a variation of delay occurred on the side of base stations causes phase error between them. In the tree system, although it is possible to reduce a total length of transmission lines, a variation of delay is increased correspondingly to the provision of the signal distributor. Therefore, when bit rate of a digital paging signal is increased, it is difficult to maintain phase synchronization between transmission outputs of a plurality of base stations. When a plurality of signal distributors are used, phase correction in base stations arranged in downstream side of the distributors becomes difficult.

BRIEF SUMMARY OF THE INVENTION

Object of the Invention

Therefore, an object of the present invention is to provide a radio paging system having connection lines for

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satellite as a reference. Therefore, it is possible to prevent an interference between output signals from adjacent base stations when the modulated radio frequency carriers are received by the paging receivers.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other objects, features and advantages of this invention will become more apparent by reference to the following detailed description of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a block circuit diagram of a first embodiment of the present invention;

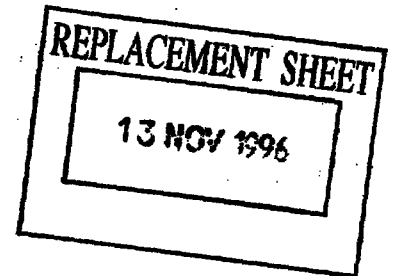
Fig. 2 is a detailed block circuit diagram of a central control portion of the embodiment shown in Fig. 1;

Fig. 3 is a detailed block circuit diagram of a coding control portion of the embodiment shown in Fig. 1;

Fig. 4 is a flow-chart showing an operation of a paging controller of the embodiment shown Fig. 1;

Fig. 5 is a timing chart showing a format of a paging request signal in the embodiment shown in Fig. 1;

Fig. 6 is a timing chart showing a relation in time position of signals in the coding control portion shown in Fig. 3;



transmitter 240 for outputting a radio frequency carrier modulated with the digital paging signal, on the basis of the time information. The base station 21 has an identical construction to that of the base station 20 and so details thereof are omitted in Fig. 1.

The GPS receivers 150 and 230 may have identical construction. It should be noted that means for producing clock pulse and time information synchronized with the universal standard time using the GPS receiver is well known and a method for calculating exact time at two mutually remote points based on the time information is disclosed in U. S. Patent No. 5,134,407. An original object of the GPS receiver is to detect position, that is, to know a position of the receiver on the basis of orbital information and time reference information from a plurality of GPS satellites. The respective GPS satellites are provided with atomic clocks using cesium and rubidium to which an information of time error with respect to the universal standard time is supplied from the ground. Therefore, the atomic clocks substantially coincide with the universal standard time. Thus, an error of time information obtained by each of the GPS receivers 150 and 230 with respect to the universal standard time is within 5 μ s, indicating very high accuracy of the time information.

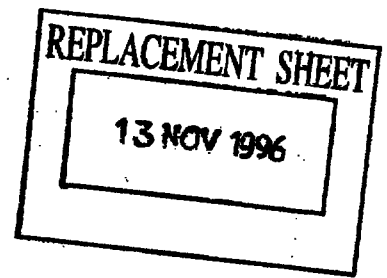


Fig. 2 shows the central control unit 120 in more detail. In Fig. 2, the central control unit 120 includes a queuing processor 121 for temporarily storing the paging call reception signal from the PSTN interface unit 110 and queuing it, a queuing timer 123 for producing a timing signal TQ having a predetermined interval indicative of an arrangement of the call reception signals on a time axis, a delay time storage 124 for storing values of the maximum delay time among delay times of the transmission lines 60 and 61 and processing times in the base stations 20 and 21, a reference time pulse generator circuit 125 for generating clock pulse and time information synchronized with the universal standard time on the basis of an output of the GPS receiver 150 and a control circuit 122 for controlling the above mentioned circuits to convert the format of the call reception signals in the queuing processor 121 into a set of paging request signals every reception of the timing signal TQ, to calculate a transmission start time on the basis of a current time indicated by an output of the reference time pulse generator circuit 125 and delay time indicated by an output of the delay time storage 124, attach a code corresponding to the calculated time to the paging request signal and supply it to the base stations 20 and 21 through the output interface units 130 and 131, respectively.

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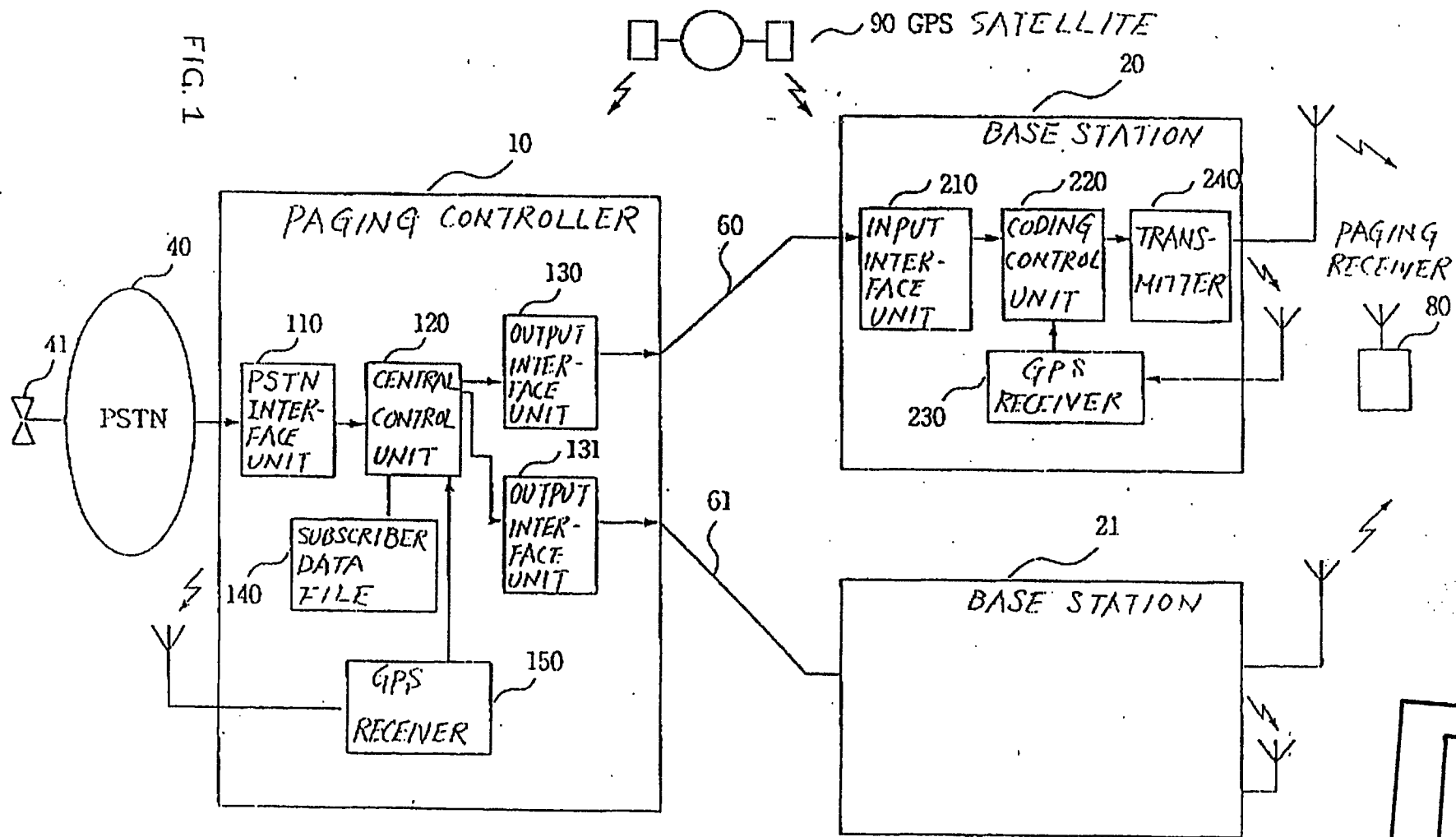
RADIO PAGING SYSTEM HAVING A PLURALITY OF TRANSMITTER STATIONS

ABSTRACT

Radio paging system having a plurality of radio frequency carriers of same frequency synchronously modulated with equal number of base stations (20, 21) having same digital paging signal and transmitted, respectively. Paging controller (10) receives paging calls through PSTN (40), preliminarily stores maximum value sum of paging request signal transmission time in transmission line and time required to process paging request signal in each base station. High precision time signal produced from reference signal from GPS satellite. Controller attaches transmission time assigning code to paging request signal. Code assigns time instance, delayed from current time determined by high precision time signal by maximum value of sum of transmission time and processing time as transmission start time. Base stations produce high precision time signal from reference time signal from GPS satellite (90) and paging request signal from transmission line processed from the high precision time signal and converted into digital paging signal synchronizing modulation of carriers.

Fig. 1

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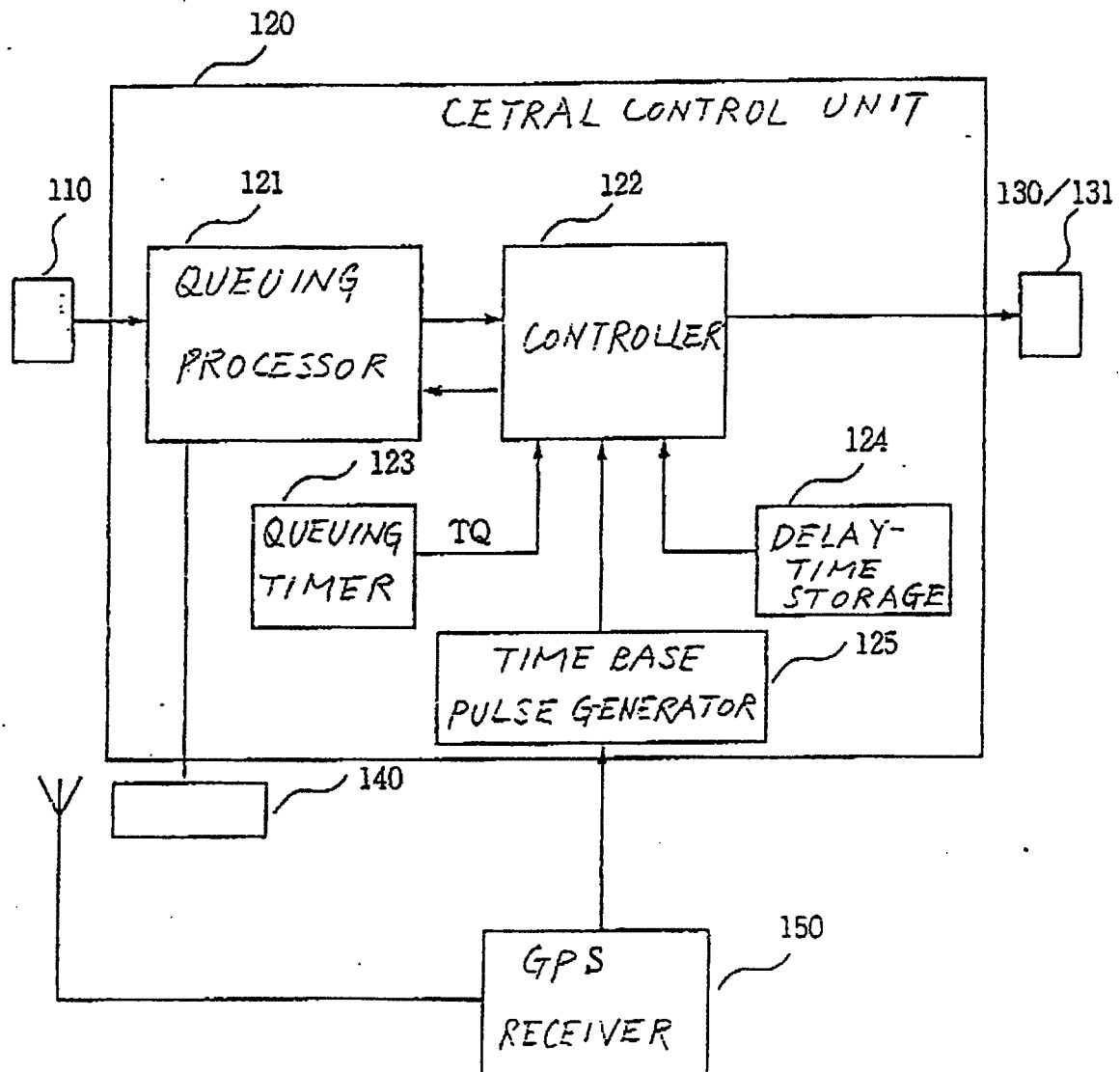


FIG. 2

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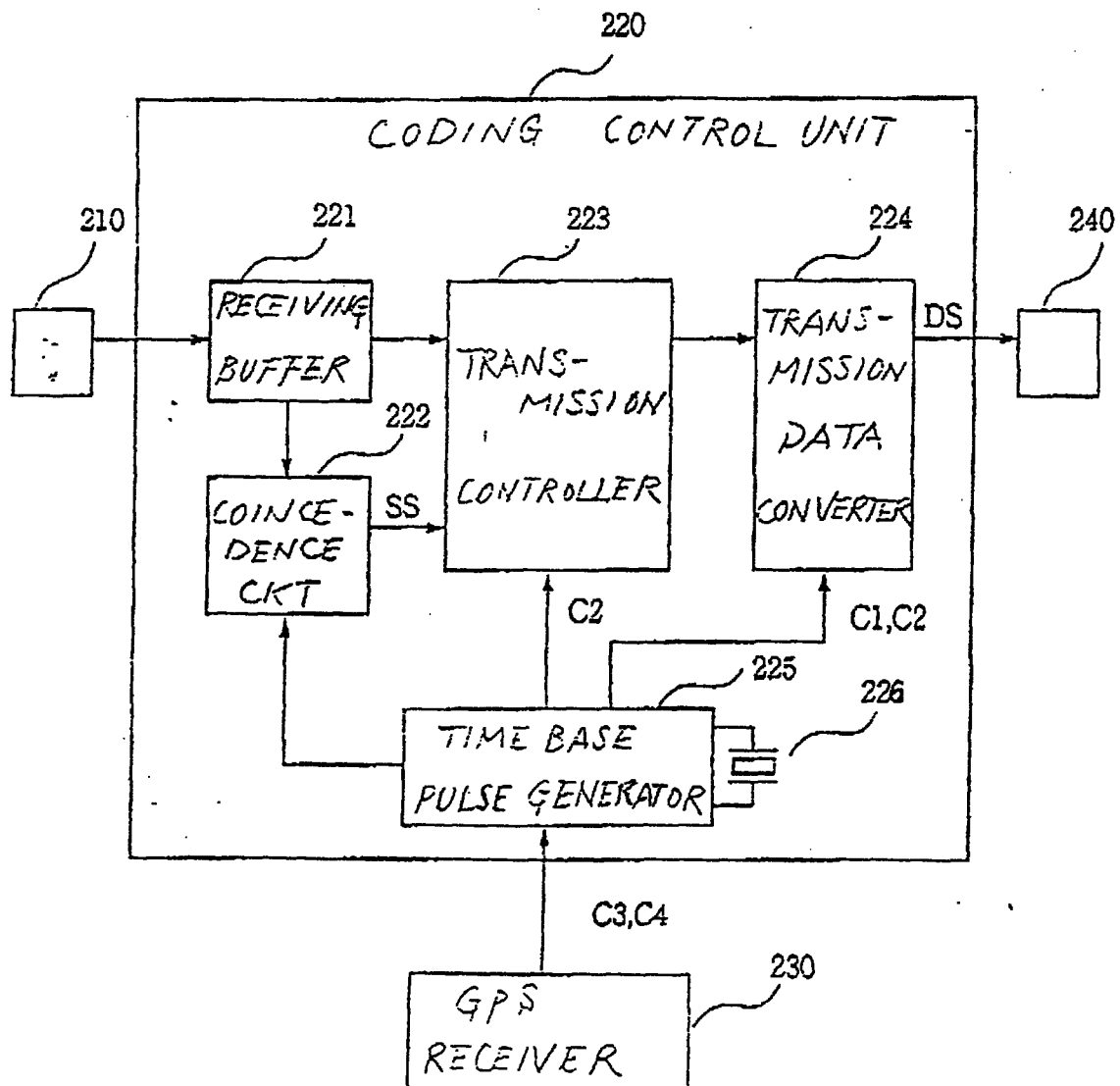


FIG. 3

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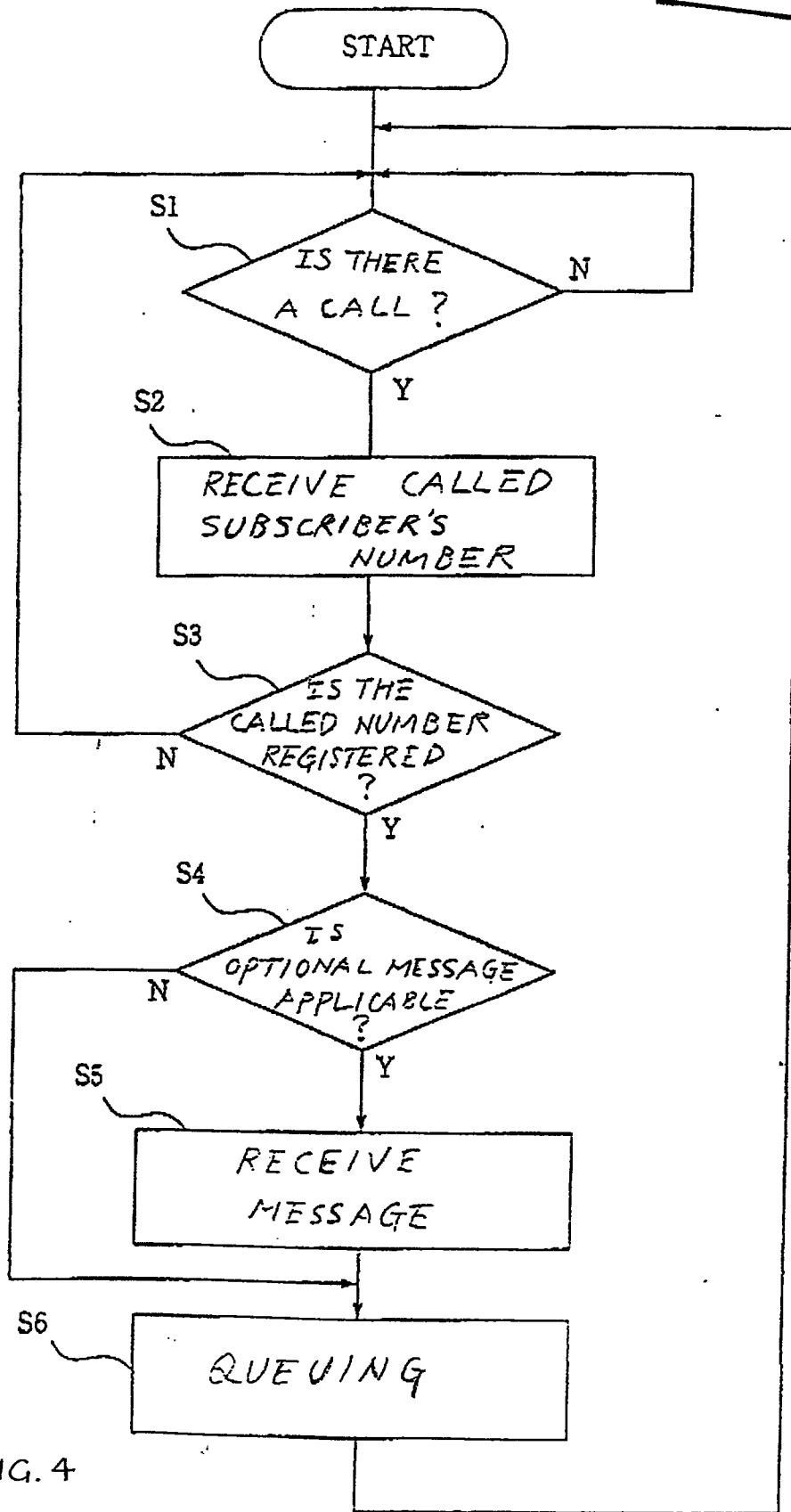
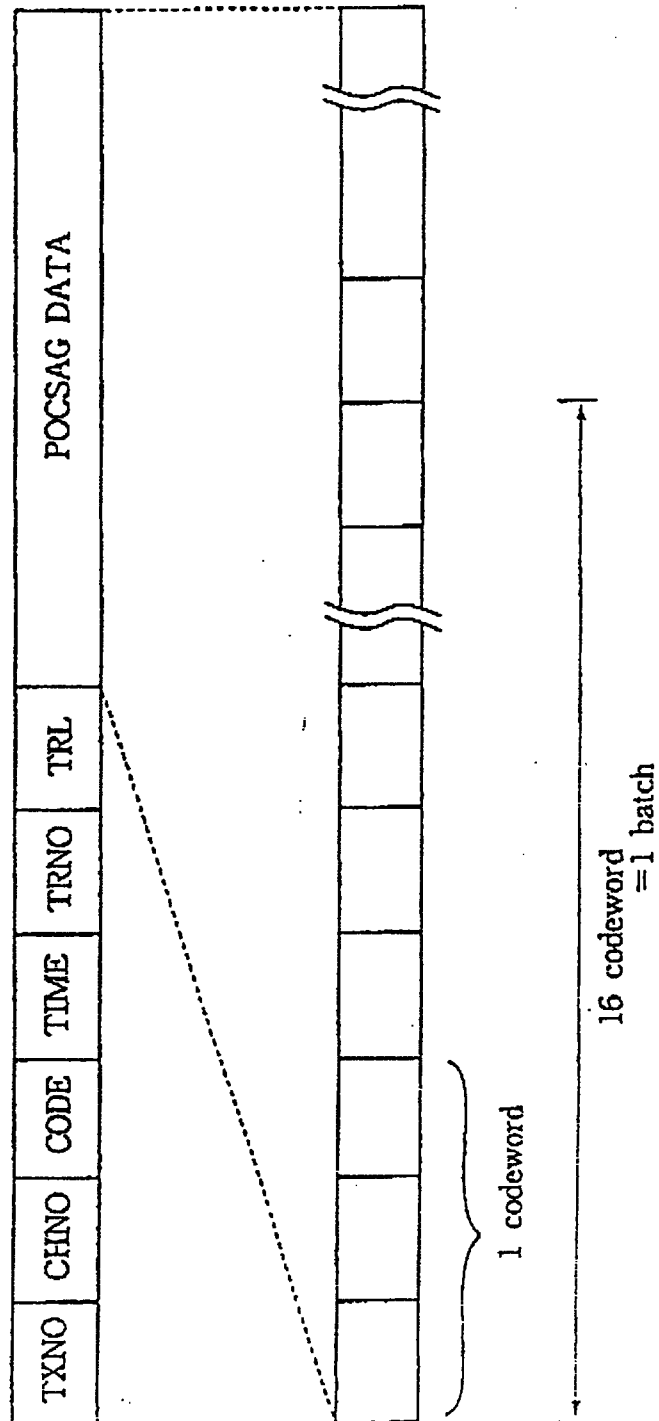


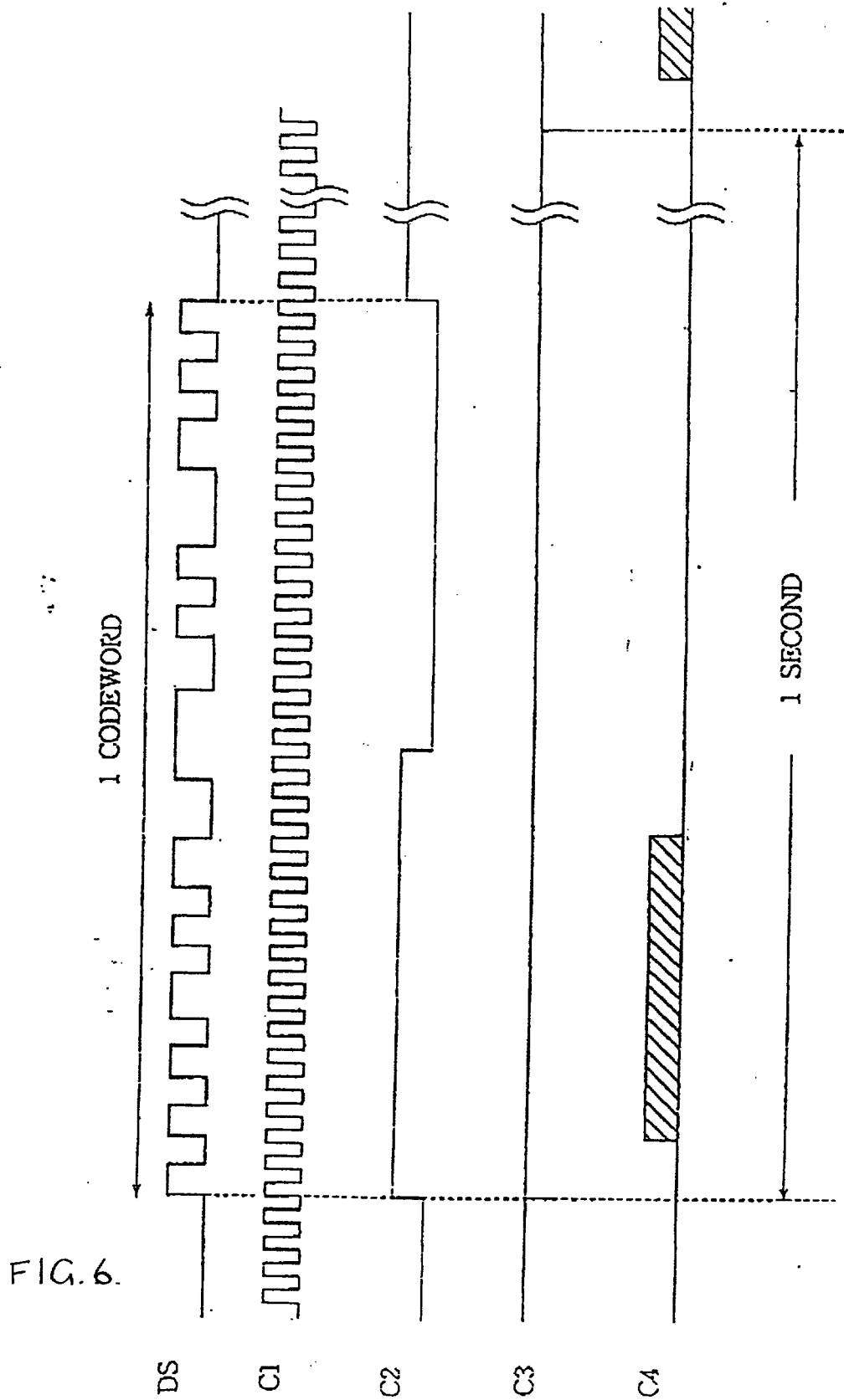
FIG. 4

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FIG. 5



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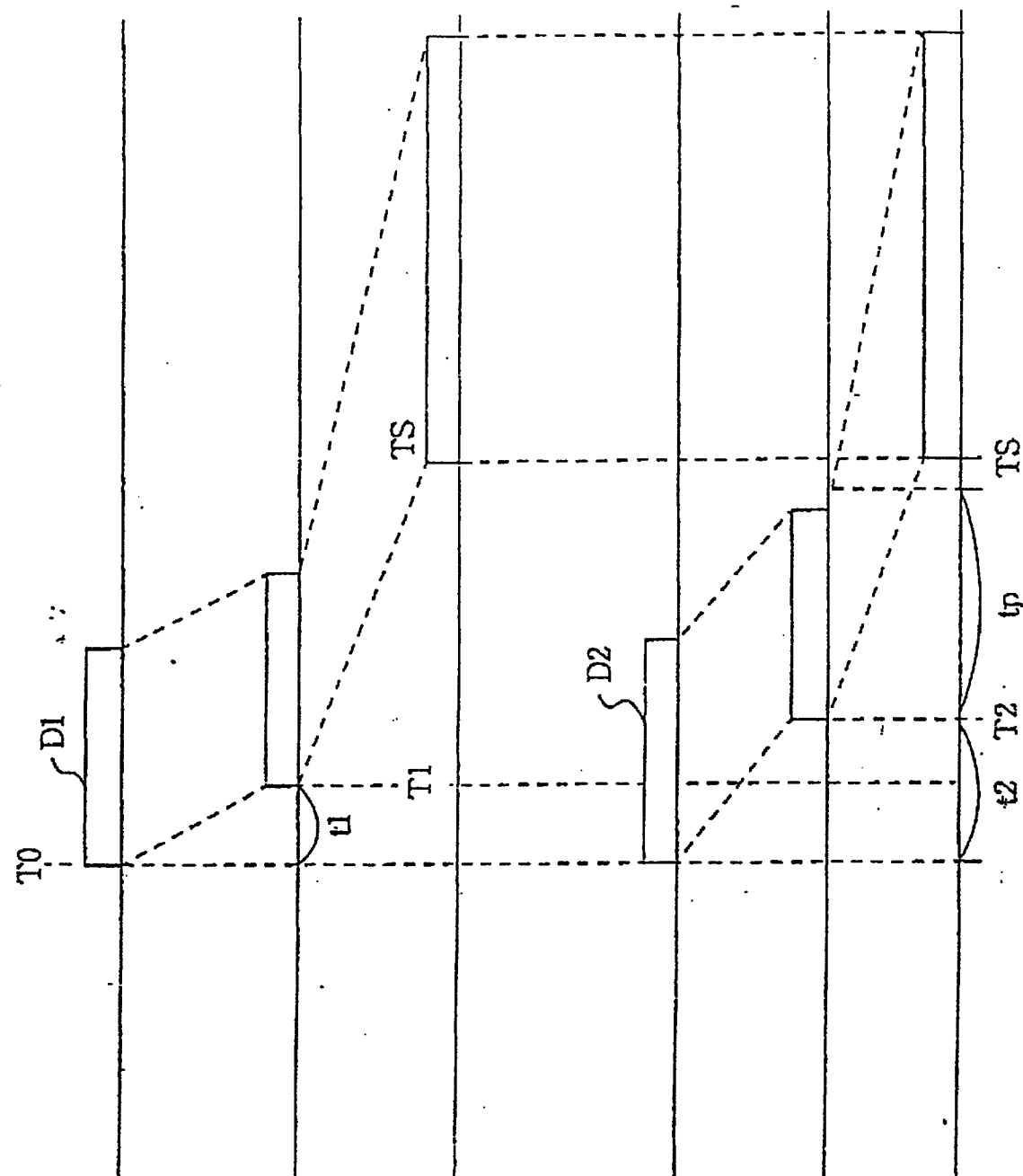
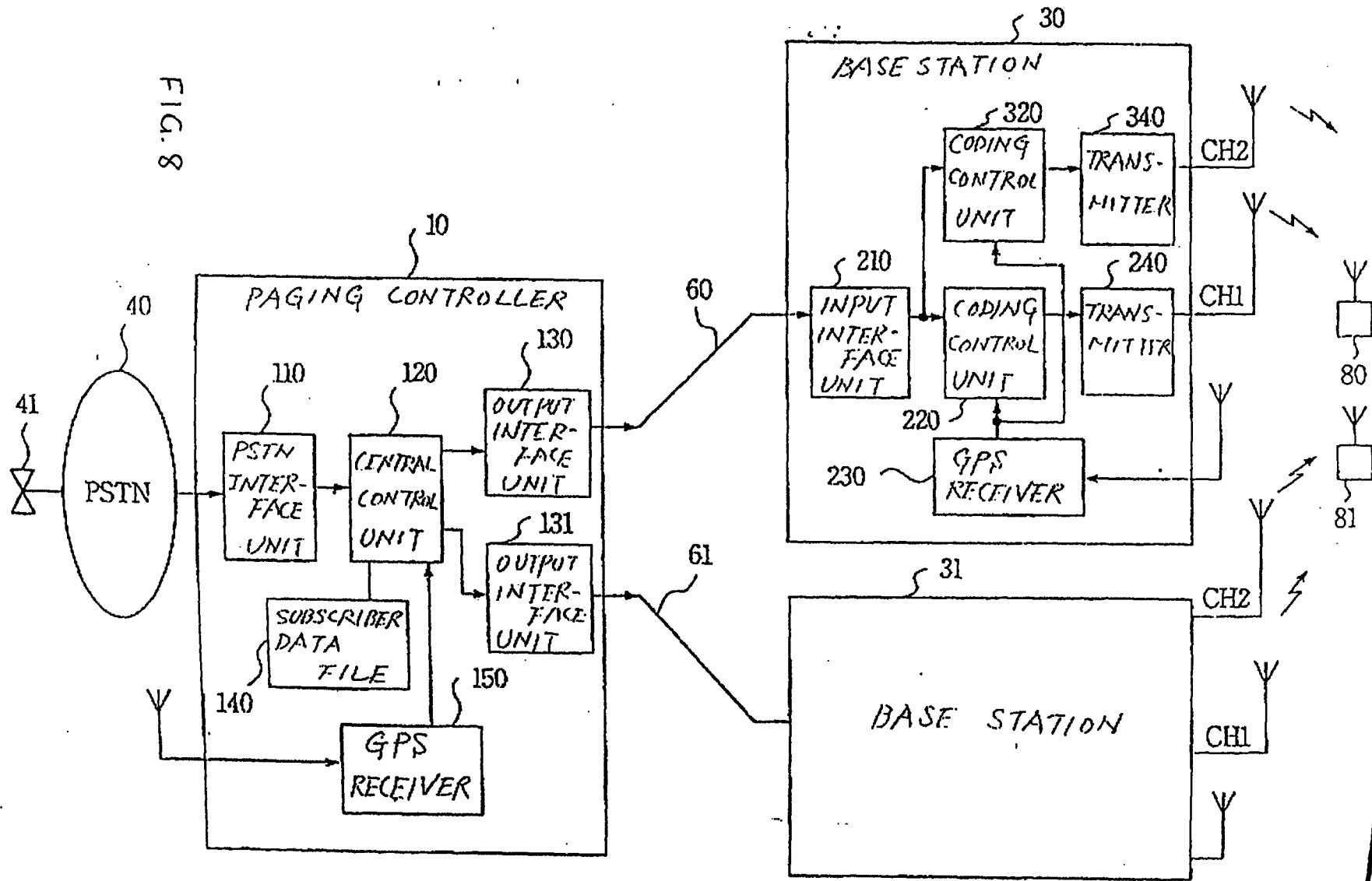
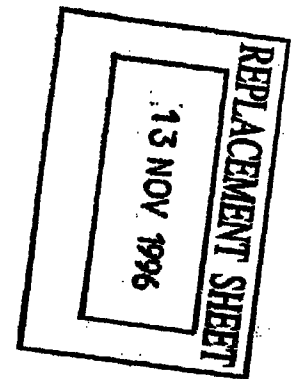


FIG. 7

FIG. 8

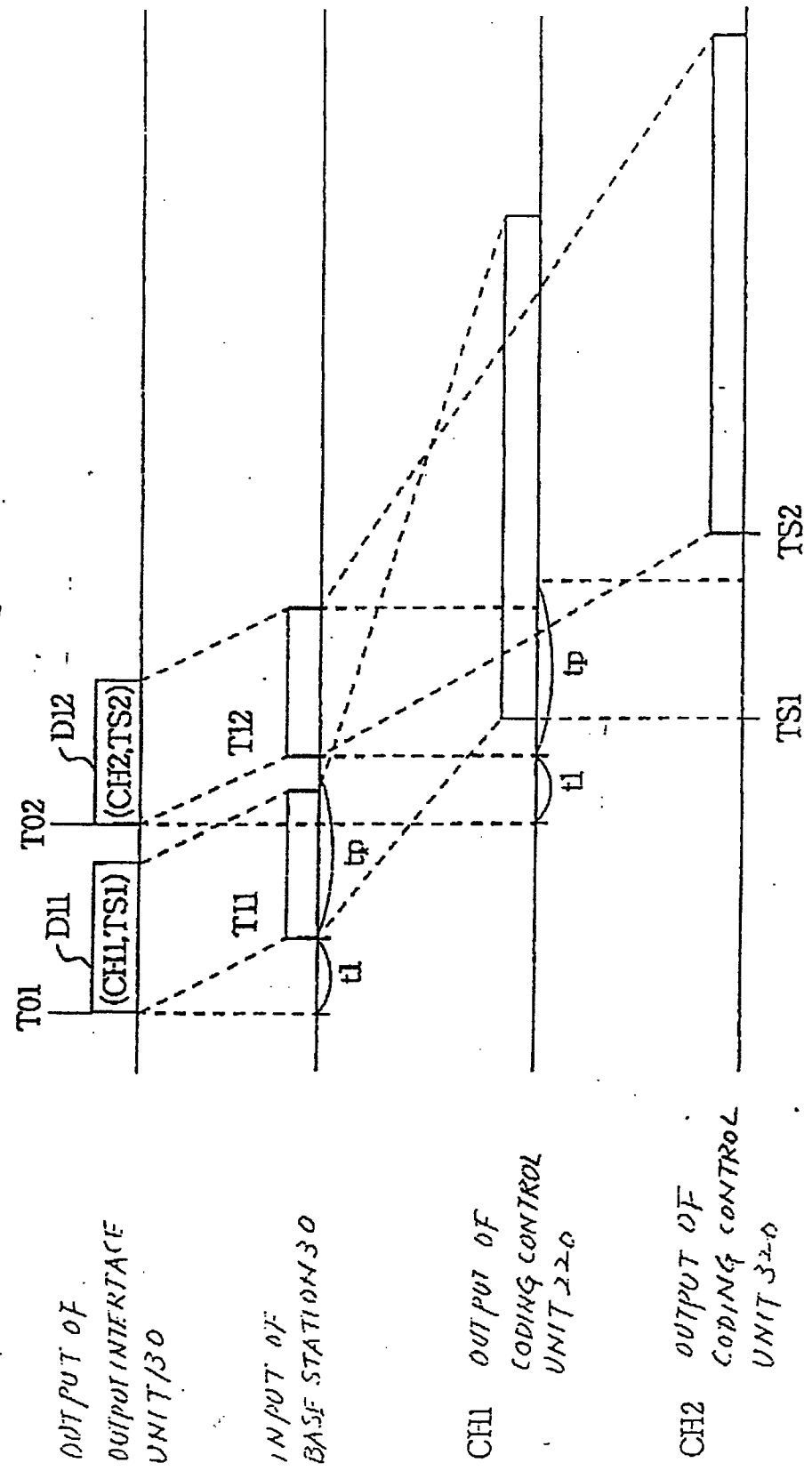


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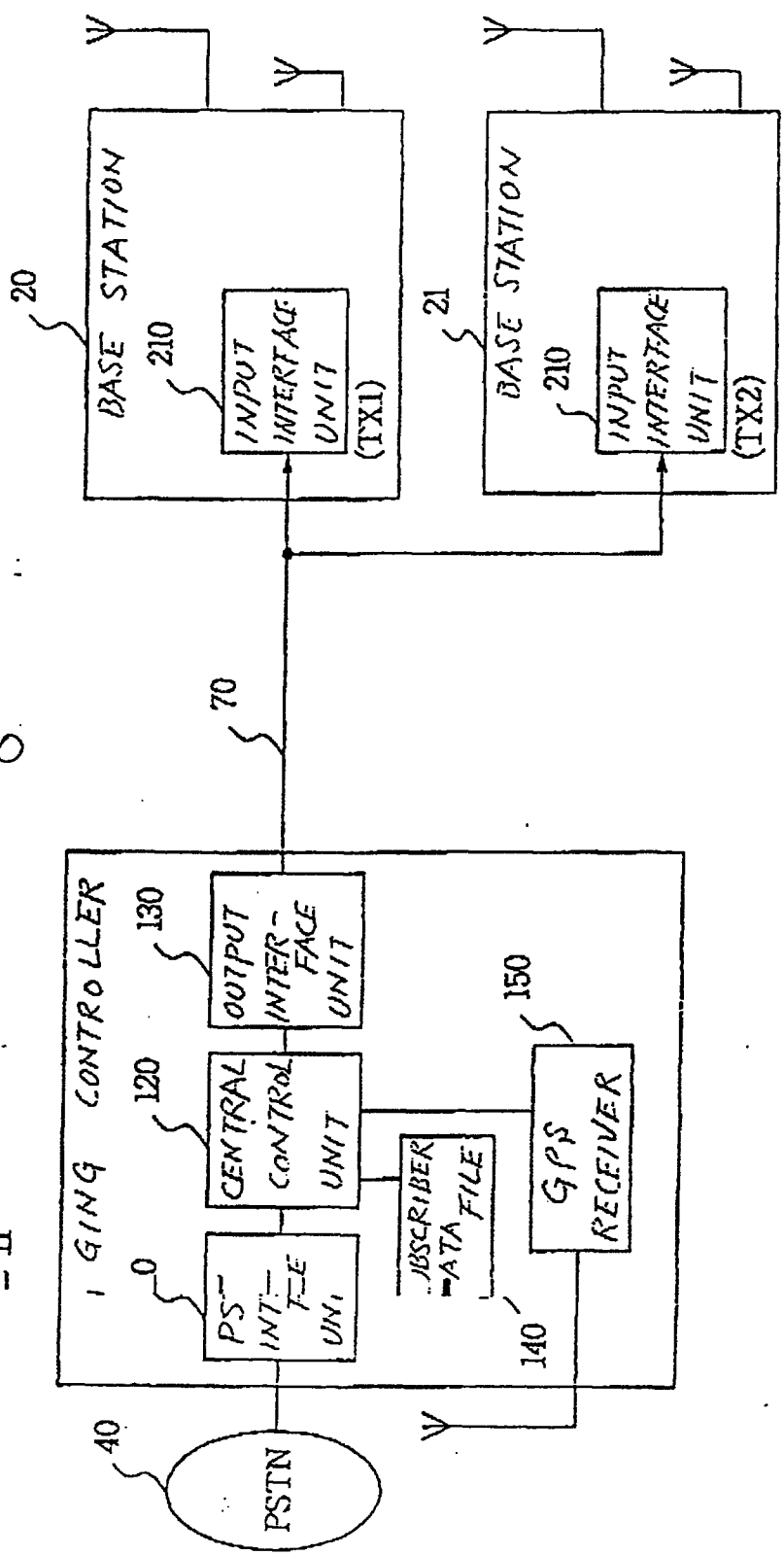
FIG. 9



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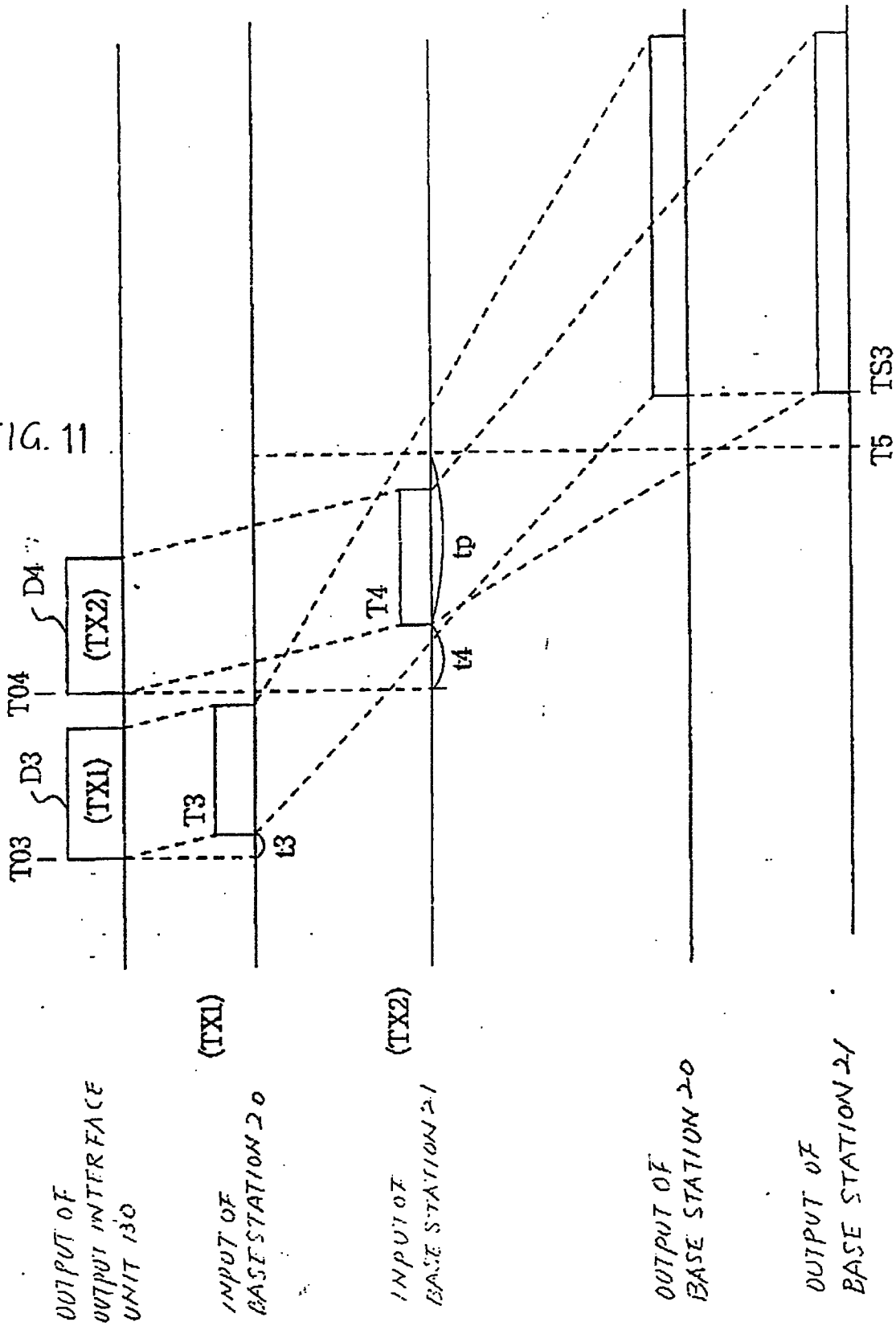
FIG. 10

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FIG. 11



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FIG. 12

