

RANA RADIO-NAVIGATORS

by Mr. Etienne HONORÉ,
E. P., E.S.E.,
and Mr. Emile TORCHEUX, L. S., E.S.E.

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Recently, there took place in the district of Paris a demonstration of a new radio-navigation process which appears to offer a complete solution to all the problems of aerial, maritime and land radio-position-fixing.

This was the first demonstration in France of a 100 % French invention called « Rana Radio-Navigators », which was presented by the « Compagnie des Compteurs de Montrouge ».

Rana Radio-Navigators are based on the principle of phase-measurement.

The very real prejudices of certain technicians towards such processes are only too well-known, but the use of some of the Rana patents by our authorized agents, the Seismograph Service Corporation (Lorac System) over a period of some years has shaken this prejudice in the United States of America and has demonstrated, through its significant achievements, the enormous possibilities of phasing systems.

The establishment of methods allowing for the use of phase measurements constitutes, in fact, the specific value of the invention on which Rana is based :

— on the one hand, by exploiting to the utmost their advantages, which are :

— accuracy of results (sensitivity in excess of 1/100 000 of the distance and conformity with geodesy on the order of 1/10 000 of the distance);

— reduction of the necessary frequency bands (enabling coverage of the entire surface of the earth with two 3 kc. bands);

— and, on the other hand, by avoiding their disadvantages by means of :
— the continuous and complete solution of the problem of the identification of equi-phase curves;

— the eradication of disturbances or deviations due to the instability of the apparatus.

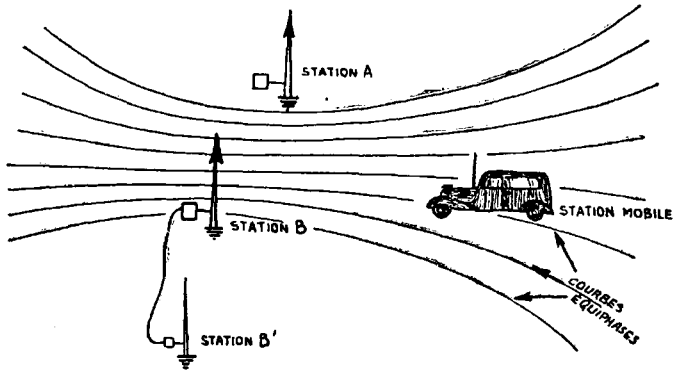


Fig. 1. — General arrangement of the trial plant.

From the technical point of view, Rana is distinguished by the fact that the only operations carried out on the signals used for phase-measurement are frequency subtraction operations, the quality and adaptability of which have been abundantly demonstrated by the numerous superheterodyne appliances available.

As the scope of this report does not allow for an explanation of the general working of the Rana process, we will confine ourselves to a description of the equipment used in the demonstration referred to at the beginning of this article.

This equipment allows the occupants of any carrier (a vehicle, in this instance, but it could equally well be a ship or an aeroplane), to know, merely by the reading of a dial, their position to the nearest metre.

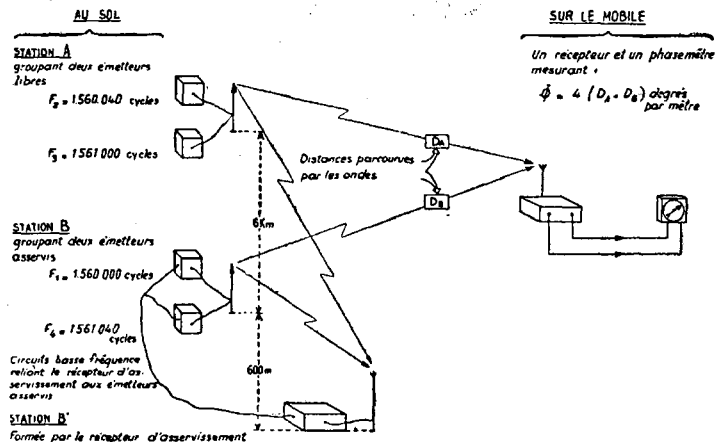


Fig. 2. — Composition of stations of the trial plant.

As will be seen in Figures 1 and 2, the basic structure consists primarily of two transmitting stations, A and B, the function of which is particularly simple, to wit, the continuous transmission of four pure continuous waves at fixed frequencies.

The four frequencies are contained in a complete band of less than 2 kc. The power transmitted by each wave is less than 1/10 watt. One of the transmitters is supplemented by a receiver which controls the synchronization of the frequencies sent out.

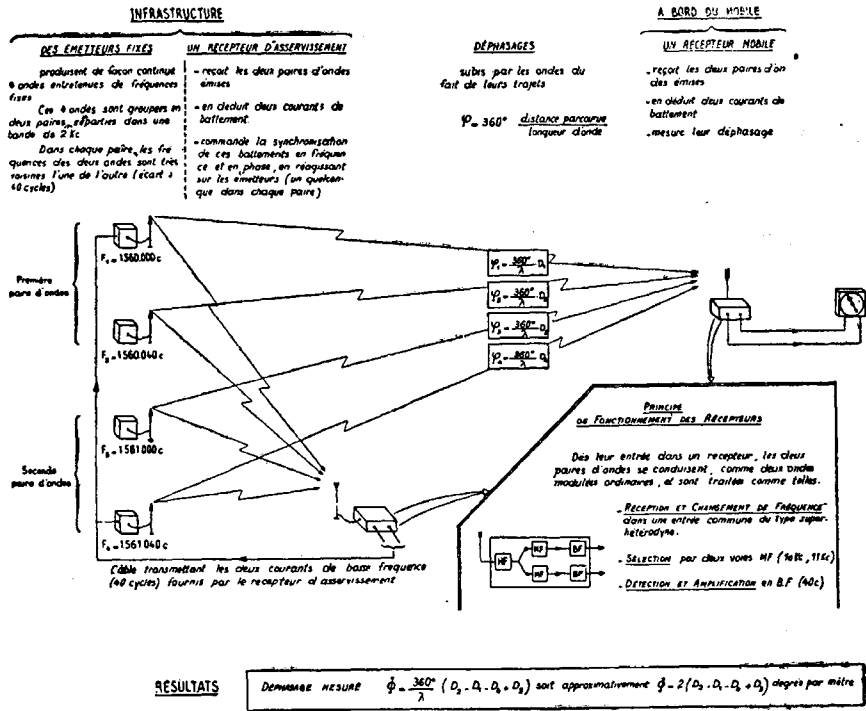


Fig. 3. — Composition and working principle of an elementary installation.

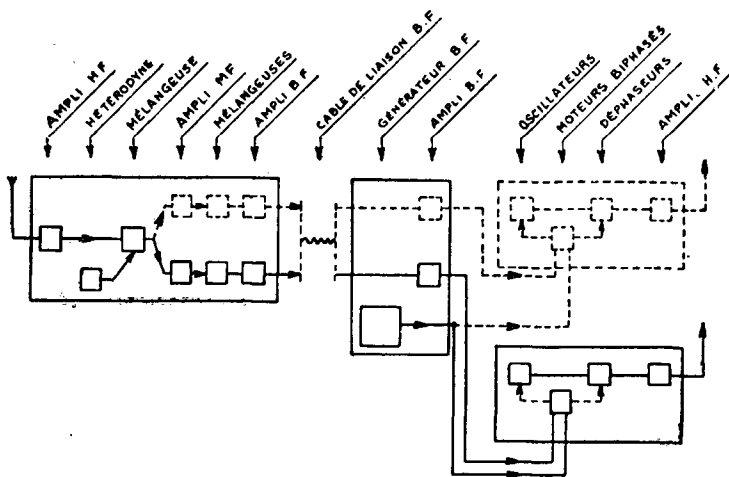
As the working of the basic structure is continuous and requires no regulating, it is almost entirely automatic.

The vehicle carries a receiver and a phase metre, the needle of which marks the vehicle's position with a sensitivity reaction of several degree per metre.

Figures 3, 4 and 5, give further information regarding the composition of the apparatus.

From the point of view of its possible uses, Rana can be employed under widely differing conditions and for widely different purposes in such a way as

to adapt itself closely to the kind of service to be rendered. In particular, it is possible to choose:



NOTA. — Le battement des deux ondes émises, l'une par un émetteur asservi et l'autre par un émetteur libre, est synchronisé, en fréquence et en phase, avec un courant de référence (de 40 cycles) produit par le générateur B.F.

Dans ce but, le moteur biphasé de chaque émetteur asservi réagit sur un condensateur d'appoint du quartz stabilisant l'oscillateur, et commande un déphaseur.

Les différents battements étant synchronisés avec le même courant de battement, sont synchronisés entre eux en fréquence et en phase.

Fig. 4. — Basic schema of slave transmitters.

- the wave-length best suited to the range required;
- the accuracy desired;
- the arrangement of the chains and the approximate location of the transmitters.

Rana equipment, therefore, offers, amongst other things, the following possibilities:

- in the range of metric waves, which are particularly useful in certain aeronautical problems, extreme accuracy can be achieved; the necessary frequency bands are relatively very narrow; transmission power is exceedingly weak;

- in the range of hectometric waves (1 500 kc.) with no sky wave and with a power of some tens of watts, it is possible to achieve a range of about 200 km. with an accuracy of a few metres (1 m. to 100 km.).

According to the conditions of the problem, even one, two or three bands of the order of one kilocycles are sufficient to cover a considerable area. In the kilometric wave range (less than 50 kc.), it is possible, with no sky wave, to achieve ranges of several thousand kilometres while still retaining an accuracy of between 100 and 500 m.

The power required for transmission is less than that required for telegraphy.

To cover Europe or the North Atlantic with a purely general net-work for use by all aerial, maritime and land carriers, it is sufficient to have three stations each transmitting from two to four pure continuous waves.

To cover the whole globe surface in the same way, it is sufficient to have one or two 3 kc. bands.

In addition, Rana offers a certain number of advantages (which are, of course, to be found in all applications of the system) which may be described as follows:

— the operation of the stations comprising the basic structure is particularly simple (i. e., the transmission of pure continuous waves at fixed frequencies) and absolutely continuous; it does not need regulating and, therefore, requires no human intervention;

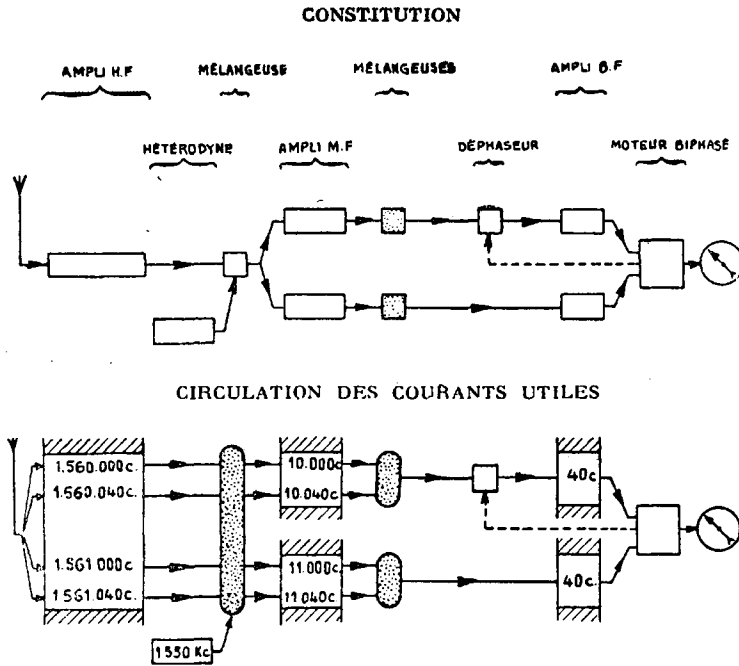


Fig. 5. — Basic principle of the receiver.

— the equipment of the carrier consists of a receiver which works (i. e., starts, stops, changes station) as simply as any ordinary receiver and its functioning is absolutely continuous, even in the establishing of equi-phase curves; accordingly, as soon as it is set in motion, the apparatus indicates automatically, and with positively no interruption, the position of the carrier; in addition, it adapts itself particularly well to the control of automatic apparatus, such as course indicators, course plotters, automatic pilots, etc.;

— no component parts which are not in current manufacture are required in the construction of the ground and mobile equipment; this, added to the fact that operation is absolutely continuous, allows for easy and reliable construction;

— the most favourable solution to the problems of integration is presented and allows, on the one hand, for the solution of radio-position-fixing problems, and,

on the other hand, for the use of mobile equipment suitable for several purposes ; for example :

— Receiver intake is conditioned solely by the frequencies used and can, thus, serve several purposes in which the same frequency bands are used;

— Receiver terminals can be used in all radio-position-fixing applications.

From the military point of view, the disturbances caused by incoherent jamming are almost completely eradicated by :

— the narrowness of the bandwidths;

— the fact that only a few seconds of reception are required to determine one's position — and this without the slightest ambiguity;

— the facility with which the transmission and reception characteristics, particularly the frequencies, can be modified quickly according to code combinations, these combinations, in fact, rendering the system unusable without the code.

With regard to deliberate jamming, the fact that the system uses several frequencies at one time makes it positively impossible for it to register incorrect information without this being noticeable to the user.

In conclusion, it must be stressed that the Rana system does not offer equipment and a solution of a definite nature, but, on the contrary, a wide range in the variety and choice of solutions.

Its variety is, in fact, sometimes disconcerting to the user who is little accustomed to being able to express his wishes and is, more often than not, forced to look for a means of adapting himself, as well as conditions allow, to the material at hand.

This is the outcome of the general nature of the principles and of the unaccustomed scope of the inventions which form the basis of Rana.

By :

— the narrowness of the required frequency bands,

— the automatic and continuous identification of the equi-phase curves, and

— the accuracy achieved,

Rana really makes the utmost use of physical possibilities; there are, in fact, no other limits than those inherent in the transmission of waves.

In other respects, the simplicity and the plainness of the equipment (which requires no operator for its continuous operation) and the facility of the receivers to pass from one chain to another, bring the best possible solution to the various problems of radio-position-fixing and to their integration.

It is obvious from these various facts that, in its widest field of application, Rana cannot be surpassed by any other system using radio-electric waves.
