# MODERN METHODS OF TIME RECORDING AS USED IN H. B. M. HYDROGRAPHIC SERVICE

by

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For some time past the time recording apparatus used by Surveying Ships of the British Navy has consisted of the following outfit :–

(*a*) An electrically fitted chronometer.
(*b*) A chronograph complete with tape and ink pens.
(*c*) An incidence marking key, or "toucher".
(*d*) An incidence measurer.

They were, and still are, manufactured by Messrs T. & F. MERCER of St. Albans, and up to a point have satisfied requirements.

The advent of the prismatic astrolabe, the great improvement in portable wireless sets and, above all, the regularising and establishment of the Rhythmic Time Signal has again brought the time recording element, i.e., the chronograph, under review.

Various complaints have, however, been received from time to time during the past few years and they have now formed the basis of a thorough investigation, of which the following is a synopsis :–

## (1) *THE CHRONOMETER.*

No alteration has been made in design, but it is now standardised so as to make contact every second, missing the fifty-ninth. It is fitted with a small microphone and terminals for use with distant head phones and in addition has a "start and stop" lever, which can be used for stopping the chronometer when transport over considerable distances or rough going is necessary.

## (2) *THE CHRONOGRAPH.*

The chronograph in use during the last decade was fitted with two ink pens, both electrically operated, one by the chronometer contacts and the other by the incidence marking key. This arrangement has been found quite satisfactory under ordinary conditions, and in Observatories, etc., is of course, the standard method of recording. Many complaints have, however, been received from abroad, especially from observers in the tropics, of the great difficulties encountered with the ink and pens. The pens became clogged, sometimes due to the thickening of the ink, sometimes by the clouds of small insects whose idle curiosity overcame their discretion and drove them into the pens ! Another complaint, and a very serious one, was that the ink would

FIG. 1.

| | | |
|---|---|---|
| 1. | Spare Tape. | Ruban de rechange. |
| 2. | Reel for used Tape. | Réa pour ruban utilisé. |
| 3. | Chronograph. | Chronographe. |
| 4. | Case. | Coffre. |
| 5. | Chronometer carrying case. | Boîte servant au transport du chronomètre. |
| 6. | Chronometer. | Chronomètre. |
| 7. | Terminals. | Bornes. |
| 8. | Lid. | Couvercle. |
| 9. | Tape in use. | Ruban en service. |
| 10. | Incidence measurer (obsolete). | Ancien appareil mesureur d'intervalles entre les enregistrements des tops (désuet). |
| 11. | Incidence marking key. | Clef servant à enregistrer les tops. |
| 12. | Tape. | Ruban. |

FIG. 2.

| | | |
|---|---|---|
| 1. | Tape. | Ruban. |
| 2. | Adjustable brake. | Frein réglable. |
| 3. | Winding key. | Clef servant à bander les ressorts. |
| 4. | Wiring diagram. | Plan des connexions électriques. |
| 5. | Needles. | Aiguilles. |
| 6. | Magnets. | Aimants. |
| 7. | Tape. | Ruban. |
| 8. | Electrical connections. | Bornes des connexions électriques. |
| 9. | Two speed gear. | Mécanisme à deux vitesses. |
| 10. | Starting switch. | Commutateur de départ. |

FIG. 3.

| | | |
|---|---|---|
| 1. | Magnets. | Aimants. |
| 2. | Spring. | Ressort. |
| 3. | Hinge. | Charnière. |
| 4. | Needles. | Aiguilles. |
| 5. | Winding stem. | Pivot pour le montage et pour le bandage du ressort. |
| 6. | Two speed gear. | Mécanisme à deux vitesses. |
| 7. | Brake. | Frein. |
| 8. | Tape. | Ruban. |
| 9. | Roller. | Rouleau. |
| 10. | Electrical connections. | Jonctions électriques. |

FIG. 4.

| | INCIDENCE MEASURER. | APPAREIL DE MESURE D'INTERVALLES ENTRE LES ENREGISTREMENTS DES TOPS |
|---|---|---|
| 1. | Diagonal converging lines. | Lignes diagonales convergentes. |
| 2. | Cursor. | Curseur. |
| 3. | Transparent celluloid or xylonite. | Celluloïde transparent ou xylonite. |

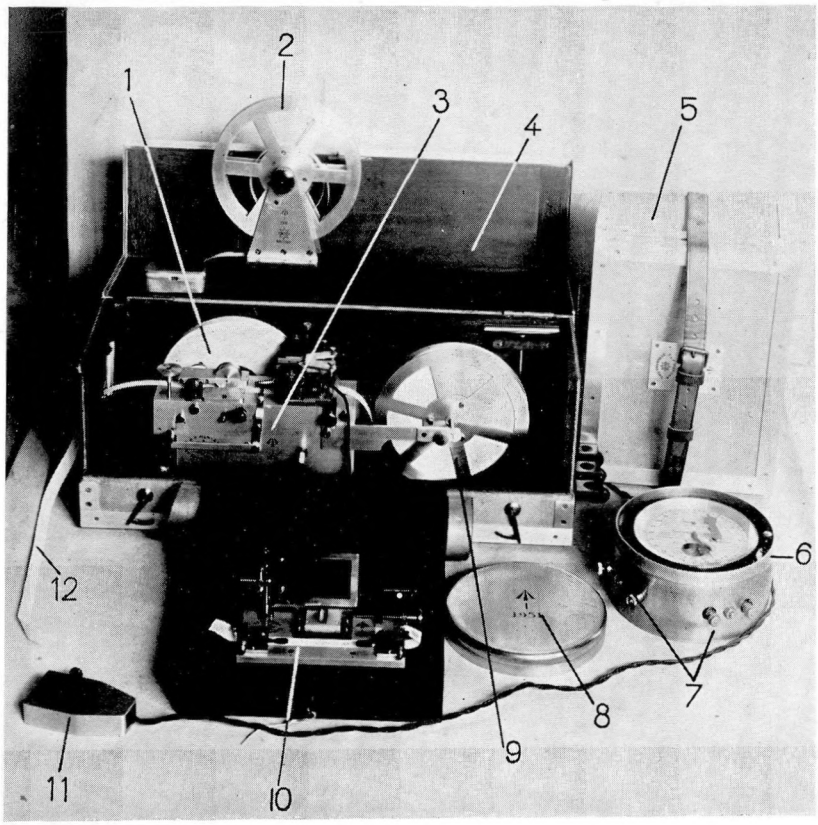


FIG. 1

*General layout of gear* — *Ensemble du mécanisme*

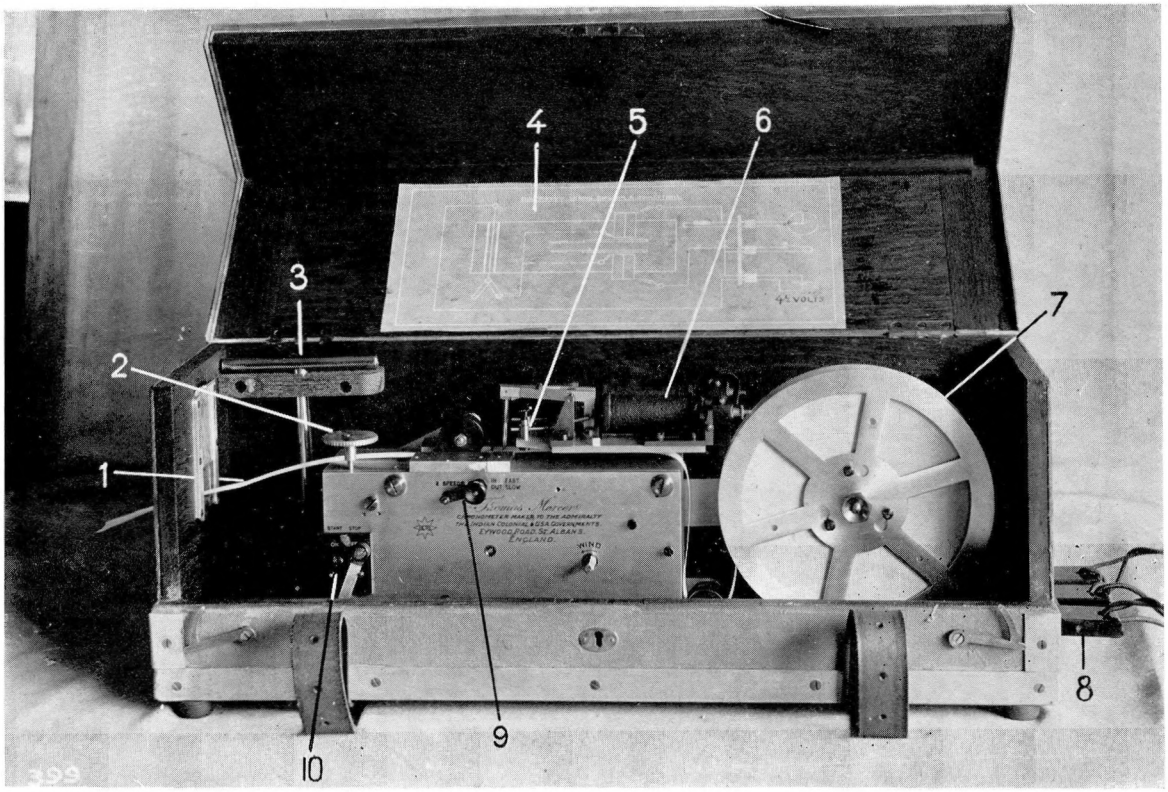


FIG. 2

*General picture* — *Aspect général*

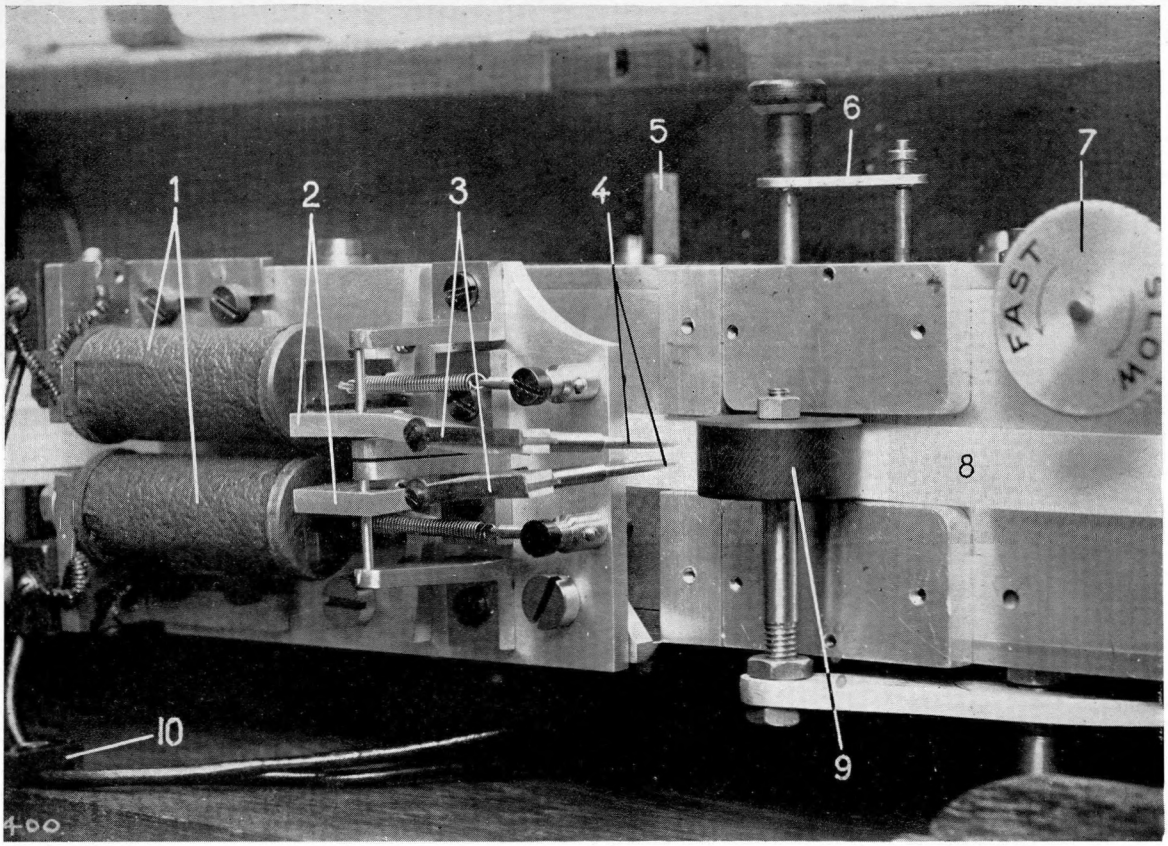


FIG. 3

*Recording mechanism.*
*The needles with their hinges and springs.*

*Mécanisme d'enregistrement*
*Les aiguilles avec leurs charnières et leurs ressorts*

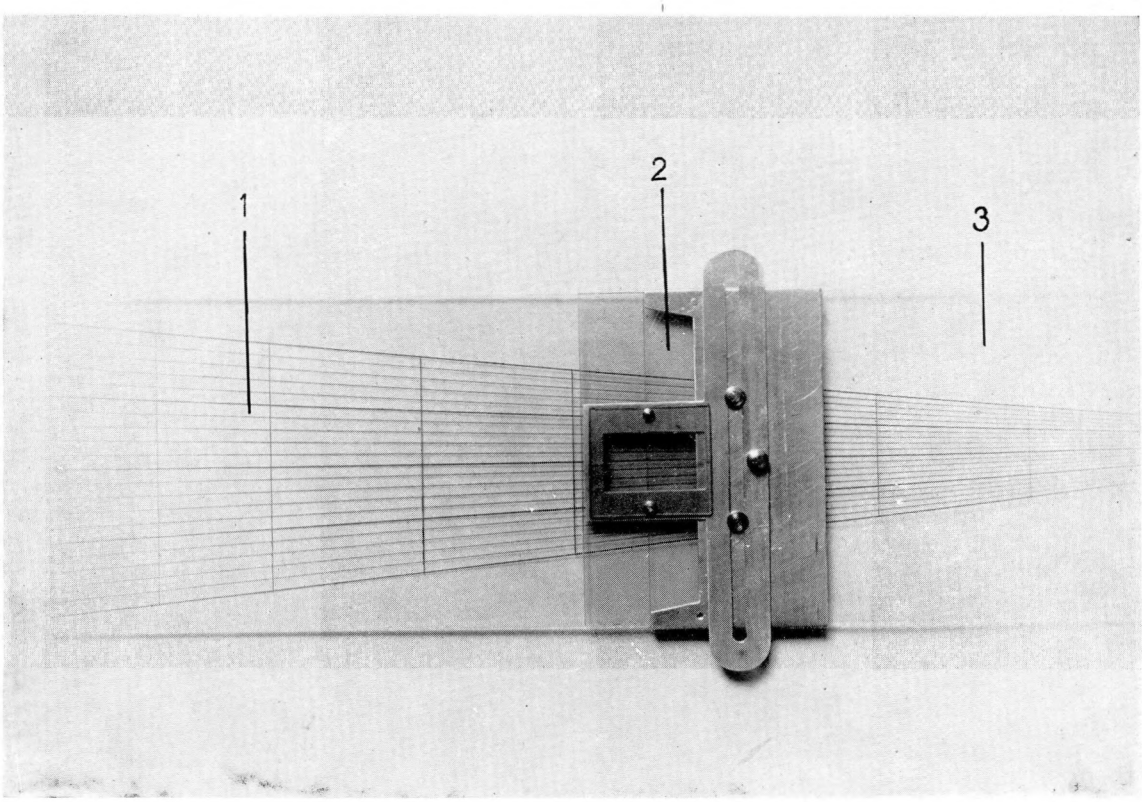


FIG. 4

*Simple form of incidence measurer.*

*Forme simple de mesureur d'incidence*

not dry and the night's output of time-keeping was not infrequently represented by hundreds of feet of paper tape hung on the neighbouring bushes to dry.

It is probable that the first chronograph in continuous use was the instrument constructed for the Royal Observatory, Greenwich, in 1856 by AIRY. The moments of incidence were marked by punctures in a moving tape, and apparently proved highly satisfactory when in use at the Observatory, and with this old model in mind it was decided to revert to the first ideas so ably demonstrated some 75 years ago.

In order to prevent interference in the even movement of the tape during the moment of puncture AIRY mounted his needles (in reality more like thin steel pencils) on a stiff spring designed to allow freedom in the movement of the pointed ends of the needles in the direction of the movement of the paper. Later on in a different type of portable machine, for some time in use in the Surveying Service, the needle was pivoted at one side and held up to its work by a light spring. This last instrument, made by a Swedish watchmaker named LINDQUIST, was a delightfully built model, but was found to be too delicate in its works and unfit for use in the field in the conditions under which it was sometimes necessary to work. In addition, certain suspicion was thrown on the pivoting movement of the needle, which was sometimes found to stick and interrupt the steady movement of the tape.

To overcome this difficulty a larger and stronger instrument was perfected by Messrs T. & F. MERCER, who arranged for the needles, very much larger ones, to be hinged at the head and held in a vertical position by a light spring, so arranged that after puncturing the tape the needle point was lifted and carried along by the tape until its angle departed sufficiently from the vertical to free itself. The impressions or punctures in the recording tape are easily seen as small holes and if the underside of the tape is lightly rubbed over with a piece of carbon paper or black lead, every impression shows up most clearly.

With the aid of the incidence measurer (*vide* 4) the time can be accurately, and without difficulty, read to .01 of a second.

The device has been thoroughly tried out in the field and is found to be completely satisfactory.

### (3) *INCIDENCE MARKING KEY.*

Many forms of this have been tried, most surveyors having their own preference. Up to the time of which we are now speaking, that is to say, the alterations from pens to needles in the chronograph, a "snap" type of key has been in general use. By that is meant a "snap" contact of very small duration of time. With, however, the advent of the needle or percussion type of marking apparatus, it soon became evident that the energising of the magnet actuating the needle required more electrical pressure than with the pen type, both from the chronometer and from the key.

With the chronometer this was easy, and the contacts were slightly enlar-

ged, a simple matter. In the case of the incidence marking key, it was not so easy and the quick "snap" through type was discarded as being too uncertain. A new pattern was evolved which, retaining the advantages of giving a "double pull-off", yet gave a continuous contact until released. This has now been adopted for the future and appears to be satisfactory in its working.

### (4) *THE INCIDENCE MEASURER.*

The original incidence measuring apparatus as supplied by Messrs MERCER was both cumbersome and tedious in action and a return has now been made to the old fashioned transparent variable or diagonal scale, with the addition of a light cursor intended to co-ordinate the eye with two lines of prick holes.

The above description is of a set of apparatus intended for use in the field, either from shore parties or with parties landed by boat from some surveying vessel. It may not have the refinements of observatory apparatus but it is capable of a very high degree of accuracy.

Nothing has been said of the wireless receiver, but it has been the practice in the British Navy to use a MARCONI long wave model known as the R.P. 11 B. set. This is quite portable and can be used with a frame aerial. Rhythmic Time Signals have been received from all over the world up to distances exceeding 10,000 miles.

In conclusion, it may be of interest to note the weights of the various items given under :–

| | |
|---|---|
| MERCER Chronograph in case complete with key, etc..... | 15 lbs. |
| MERCER Chronometer in case with electrically fitted contacts | 10 lbs. |
| MARCONI R.P. 11. B. W/T set in canvas case..... | 51 lbs. |
| Frame Aerial for use with above..... | 17 lbs. |
| Phasing Unit (if required) ..... | 25 lbs. |
| H. T. Batteries in box ..... | *47 lbs. |
| L. T. Batteries including box of spares and telephones.... | *27 lbs. |

(*) *As supplied by the makers.*