

THE GRAPHIC CHRONOMETER.

BY EMILE GUARINI.

As its name indicates, the graphic chronometer, a recent invention of Dr. A. Jaquet, is employed for the graphic registration of time. It consists, in principle, of a watch having an anchor escapement of fine workmanship, the oscillations of which are, through the intermedium of a special arrangement, communicated to a registering lever. The time is registered by intervals of 0.2 of a second; but, by simply pressing a lever, it is possible to obtain the registration in entire seconds. The precise moment at which the chronometer starts to register is so sharply marked that it is possible even with a speed of 8 inches per fifth of a second, easily to determine the moment of starting within about four one-thousandths of a second.

The graphic chronometer carries, in addition, two dials and two hands, one of which indicates the seconds and the other the minutes. Upon pressing a lever, it is possible to instantly bring the two hands back to zero.

Owing to two terminals with which the apparatus is provided, it can be placed in an electric circuit and thus made to graphically register, for example, the precise moment at which a race is started. It is possible to stop or start the instrument instantaneously by means of a lever placed at the lower part of the chronometer. For cases in which the arrangement of a place would cause an electric signal to be preferred as a register of the time, the instrument has been provided with a contact that permits of affecting also an indirect registration of the time.

A control screw in front serves also for regulating the vibrations of the registering lever. The instrument is constructed with a view to being used with vertical registering drums. If, however, it is desired to effect the registration upon a horizontal drum, it suffices to lighten by means of a thumb-screw a pressure spring, which, bearing against the back part of the registering lever, serves to counterbalance the weight of the latter in a horizontal position.

As regards the accuracy of the registration of the time, numerous experiments made with several different instruments have demonstrated that the amount of probable error varies between 0.0002 and 0.0006 of a second. The control of the absolute variation is effected by observation, for several hours, of the time indicated by the hands and a comparison with a good chronometer. Such possibility of the observer's making the control of himself constitutes, along with its great accuracy, one of the principal advantages of the apparatus, which, inclusive of its case, weighs a little over five pounds.

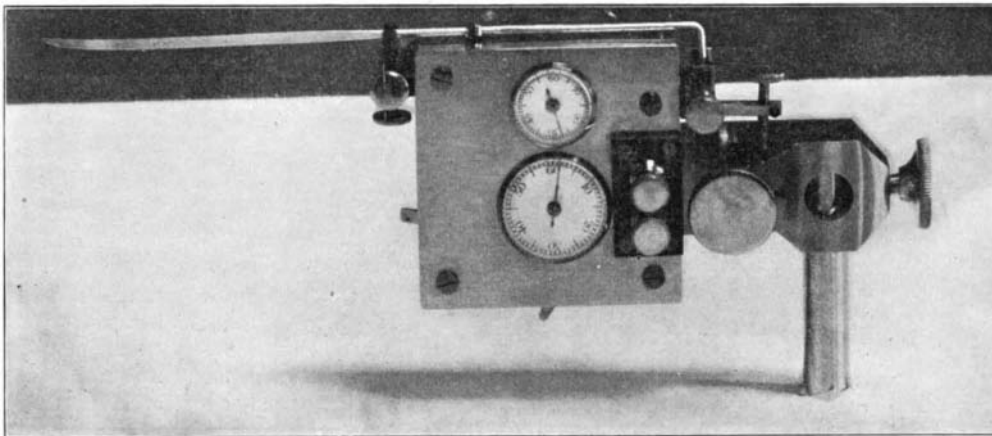
Its exceedingly compact form renders it particularly well adapted for clinical operations in which the instruments often have to be carried from one room to another, and in which an endeavor is made to avoid complicated installations.

The Atchison, Topeka, and Santa Fé Railway Company is laying some portions of its road with rails weighing 101 pounds a yard. These rails have a foot 6 inches broad, and it is thought this may render the interposition of steel plates between rail and sleeper entirely unnecessary. The fish plates used with these rails are constructed so as to embrace the foot closely. The practice of this line is to place the nuts that secure the bolts of the fish-plates alternately inside and outside the rail.

ELECTRIC DEAD RECKONER USED ON "VALHALLA" IN THE OCEAN RACE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

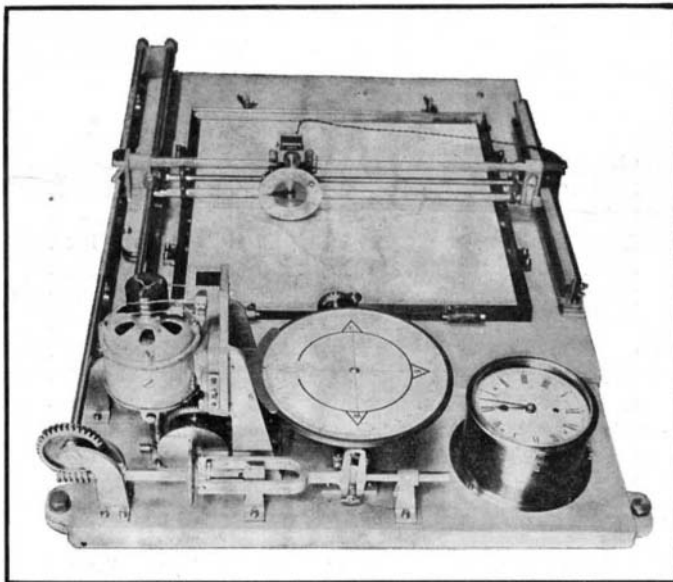
Every navigator is fully cognizant of the importance attached to "dead reckoning," when no other means of locating his position can be followed, and special interest attaches to the automatic dead reckoner, here-



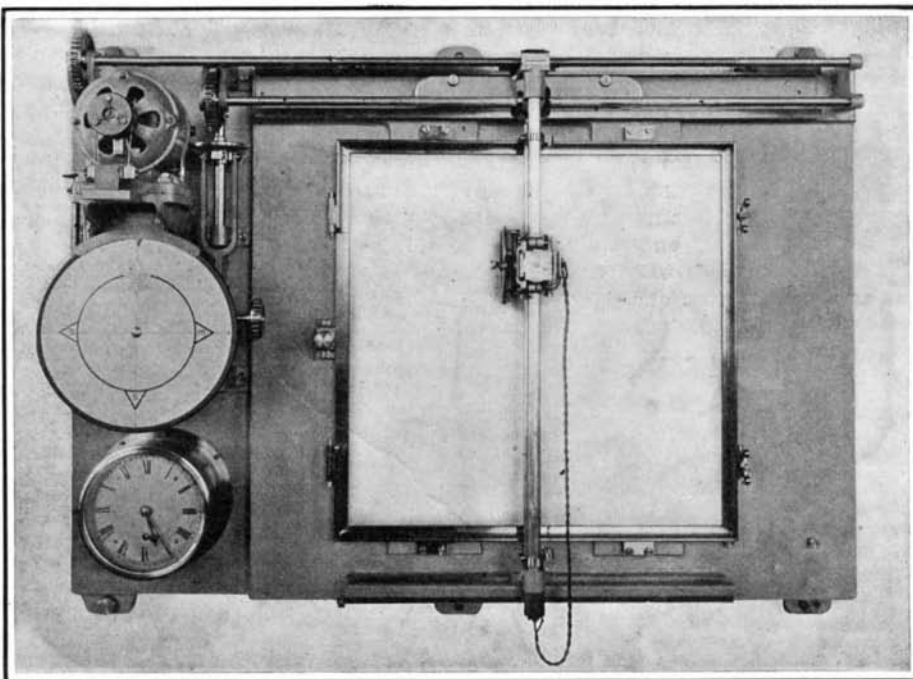
THE JAQUET GRAPHIC CHRONOMETER.

with described, which is being used on the yacht "Valhalla" in the ocean race. For the purpose of facilitating dead reckoning and to enable it to be carried out with unerring exactitude with all possibility of errors eliminated, this ingenious electric apparatus has been introduced by Messrs. Siemens Brothers & Co., London. With this instrument all chances of error are obviated, and the "course and distance" made since the last known "position left" can be taken out by inspection at any moment.

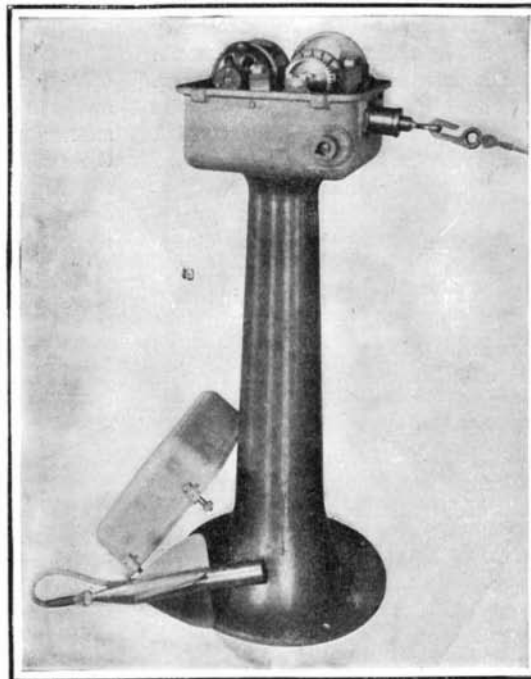
The prominent feature of the appliance is that it makes all corrections for variation, deviation, and leeway. All that is necessary to determine the "course and distance" made, is to scale the "distance" between two points on the diagram with a properly divided parallel ruler, and then slide the ruler over the faint



A View of the Recorder with Motor, Pelorus and Clock in the Foreground; the Time-Printing Wheel is Shown Over the Paper.



Plan View of the Recorder, Showing the Rectangularly Disposed Spindles, One of Which Carries a Time-Printing Wheel by Which a Record of the Ship's Course is Plotted on the Paper.



The Transmitter Which is Operated by a Log-Line and is Electrically Connected With the Recorder in the Chart-Room.

compass card printed on the diagram, and read off the "course." The rate at which the ship has been traveling at any moment can at once be read off the diagram, and the latter when filed away constitutes an actual record of the speed of the ship, and the course she was on, at every moment of time during which the "dead reckoner" was in use. The instrument comprises two essential parts, the transmitter, fixed on the poop, and the recorder, placed in the chart-room, the two being connected by a small electric cable about half an inch in diameter.

As will be seen from the accompanying illustration, the transmitter is carried on a pillar similar to a ship's compass. From the after end of the transmitter box projects a shaft terminating in an eye, to which the rotator is connected by the usual log line. This shaft carries a worm, which gears into a worm-wheel driving one half of a hunting switch, the other portion of the hunting switch being driven through suitable gearing by a small three-phase synchronous motor. The action of the mechanism is as follows: As the portion of the hunting switch driven by the rotator is revolved, it makes a series of contacts with the portion of the hunting switch driven by the motor. Directly the first contact is made, the motor starts, and by revolving the other portion of the hunting switch breaks this contact, and so comes to rest. If, however, the rotator continues to revolve, the motor will continue to run at a speed directly proportional to the speed of the rotator.

The recorder is mounted on a frame about 40 inches in length by 30 inches in width, on which frame are carried two screw spindles at right angles to each other, one of which is termed the north spindle and the other the east spindle. The north spindle is carried by a nut in which the east spindle works, and on a nut worked by the north spindle is fixed a time printing wheel. The north and east spindles are operatively connected with a "pelorus."

The mechanism controlling the pelorus is driven by a motor synchronized with the motor on the transmitter. By this arrangement, therefore, the travel of the timewheel is directly proportional to the distance traversed by the ship, quite independently of the direction in which the timewheel travels.

Consequently, as the direction of travel of the timewheel is controlled by the position of the pelorus relatively to the index, the line traced by the timewheel is, in length, directly proportional to the speed of the ship, and its direction is that indicated by the pelorus, namely, the course.

The timewheel is a circular brass wheel about four inches in diameter, having on its periphery numerals from I. to XII. representing hours, each hour being divided into quarters. Normally, this wheel is held away from the paper by a spring, but every 15 minutes an electric current is transmitted by a clock, which forms part of the apparatus, to an electro-magnet. This causes the wheel to press against the paper and the time as shown by the clock is recorded thereon. The wheel has a ratchet wheel fast with it, with 48 teeth, engaging a

pawl. As soon therefore as the magnet has depressed the wheel to print, the spring withdraws it, and the pawl turns the wheel one forty-eighth of a revolution, ready for the next impression. The printing wheel is inked by a spool, against which it bears when at rest. The course is indicated by a series of dots printed by the timewheel. At every fourth dot the hour is also printed. By this means it is possible to obtain a more accurate result