A PORTABLE SPARK CHRONOGRAPH FOR EITHER DIRECT OR ALTERNATING CURRENT.

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The simplicity of operation and the speed with which measurements may be taken, makes the spark chronograph very useful for laboratory purposes and also in taking measurements outside the laboratory as the current available is direct or alternating current, and on any voltage from 50 to 250.

The instrument is capable of recording six events. The number of events could be increased without materially increasing the cost of construction.

Figure 1 shows a cross section of the chronograph. (*M*) is a series wound motor provided with ball bearings. The shaft (*S*) carries the rotor (*R*) and governor frame (*F*). The latter is provided with a governor arm (*g*), hinged at (*h*). The weight (*w*) is attached to the arm (*g*) and is counterbalanced by the spring (*sp*). The arm (*g*) carries a contact member (*s*), which bears against a contact screw mounted on the bracket (*Br*). A lock nut (*n*) holds the lower contact member in any desired position. These contact members are shunted across a resistance which is in series with the motor windings.

When the speed of the motor is low, the contact at (*s*) is closed and the full voltage is applied to the motor. When the speed of the motor reaches a value sufficient for the centrifugal force of the weight (*w*) to overcome the tension of the spring (*sp*), the contact (*s*) is opened. This places a resistance in series with the motor and thus lowers the voltage so that the motor speed decreases. The making and breaking of the contact (*s*) results in a relatively constant motor speed.

FIG. 1.

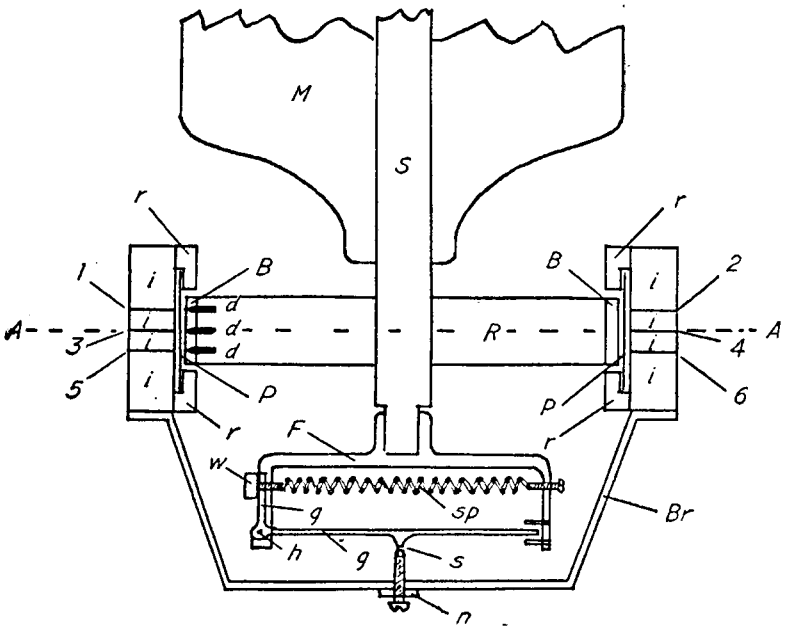


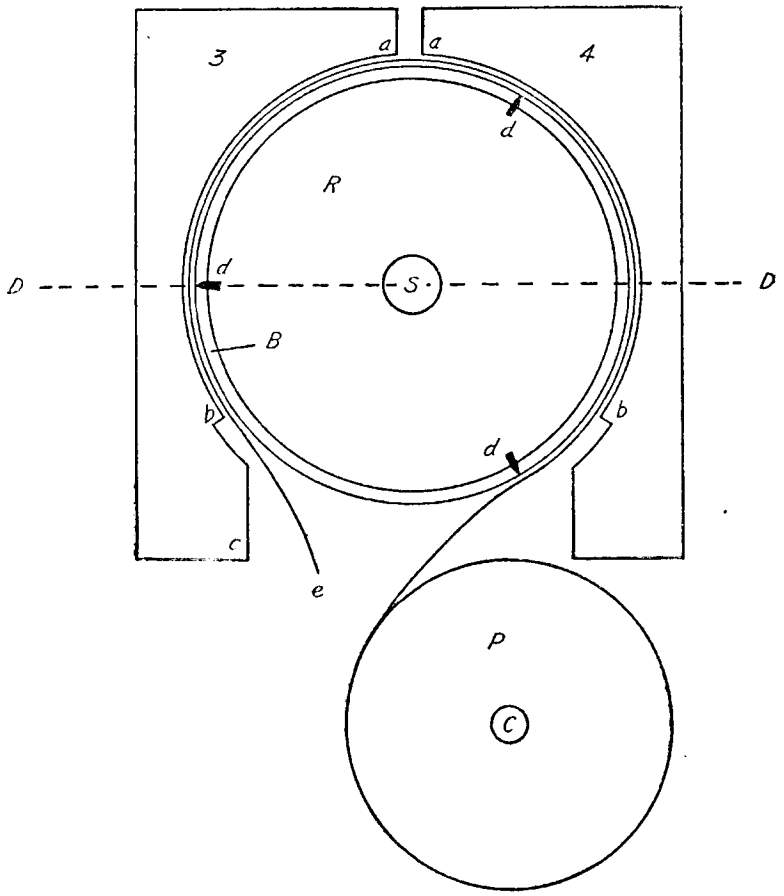
Figure 2 shows a section of the chronograph at *AA* of Fig. 1. (*S*) is the motor shaft which carries the metal rotor (*R*). The circumference of the rotor (*R*) is covered

with a ring of bakelite (*B*). The metal pins (*d*) are located 120 degrees apart, are set in the metal rotor (*R*) and project through the bakelite ring (*B*) so that their points are flush with the surface.

A roll of chronograph paper (*P*) is supported on a core (*C*). The paper passes around the rotor.

The segments 3 and 4 are made of metal and are connected to the terminals of the secondary spark coils. The spark passes through the paper from (*d*) to one of the segments. Each segment (*ab*) represents 120 degrees.

FIG. 2.



Suppose it is desired to know the time between the two events that are being recorded by segments 3 and 4. When the spark passes from (*d*) to segment 3, a record is left on the paper. If both events occurred simultaneously, another spark would pass from another (*d*) to segment 4. The distance between these records on the paper would be equal to one-third the circumference of the rotor and would be labeled zero on the measuring scale. If the second event did not occur simultaneously, but, say, .003 second later, the rotor would have travelled a certain distance in this time. The distance between the records on the paper would then be equal to either the distance moved over by the pin (*d*), or to this distance plus one-third the circumference of the rotor. Therefore the measuring scale is double and is made so that it reads the time between the events directly in thousandths of a second.

In Fig. 1 (which is a section of Fig. 2 at *DD*), it will be seen that there are six segments. These segments are mounted between bakelite blocks (*i*). Two bakelite rings (*r*) guide the paper (*P*) around the rotor. These rings hold the paper about .007 inch away from the rotor. The space between these rings and the bakelite (*i*) is sufficient to take the thickest chronograph paper without binding. As shown in the figure, there are

three sets of pins (*d*). By adding more segments and a corresponding number of pins, any number of events may be recorded.

When the contact (*C*) is closed, a 4 microfarad condenser discharges through the inductor circuit in the secondary (*s*). A spark passes from one of the segments (1, 2, 3, 4, 5, or 6) to the frame of the motor through one of the pins (*d*) in the rotor.

A 25-watt lamp is used for resistance so that by its flicker one is assured that the governor is functioning properly.

The value of the resistance is easily changed to suit the voltage of the current available.

The spark coils used in the chronograph are FORD, Model *T*, ignition coils.

The width of the paper is one and one sixteenth inches. Readable records are obtained with voltages as low as 50. By using a special paper, voltages as low as 20 may be used.

The speed of the motor is 2000 R.P.M. One revolution takes .030 second. One-third revolution (the length of a segment) represents .010 second.