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P. O. BOX 245
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ABSTRACT: A portable station for recording fire weather data has been developed for use in wildland fires, prescribed burns, evaluating sites for fire weather stations, and fire research. Housed in a mechanic's tool box, the station weighs about 60 pounds. One man can have it ready to operate in about 15 minutes. The unit can record five weather variables, but additional data can be recorded by modifying the electronic circuitry. Data are recorded on strip chart recorders.

RETRIEVAL TERMS: fire weather data; weather instruments; temperature measurements; wind speed; humidity.

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A Portable Station for Recording Fire Weather Data

John R. Murray Clive M. Countryman

Wildland managers and researchers have long recognized the value of portable recording weather stations. Invaluable to fire behavior teams during going fires, portable recording stations are useful in prescribed burning and for evaluating sites for fixed fire-weather stations. They are also useful for other research studies in which a record of local weather is needed.

To fill these needs, a compact, portable fire weather station has been developed. It can measure and record wind speed and direction and wet and dry bulb temperatures. If a suitable sensor is available, the unit can also record moisture content of fuels. Housed in a mechanic's tool box, the station --including the sensors and recording equipment but without the mast--measures 18 by 10 by 13 inches (fig. 1). Any housing of appropriate size and durability can be used. Weighing about 60 pounds including the internal battery and charger, the unit can be carried about. One man can set it up and have the unit ready to operate in about 15 minutes.

Persons interested in building a similar station may find useful some of the ideas and techniques reported in this note.

SENSORS

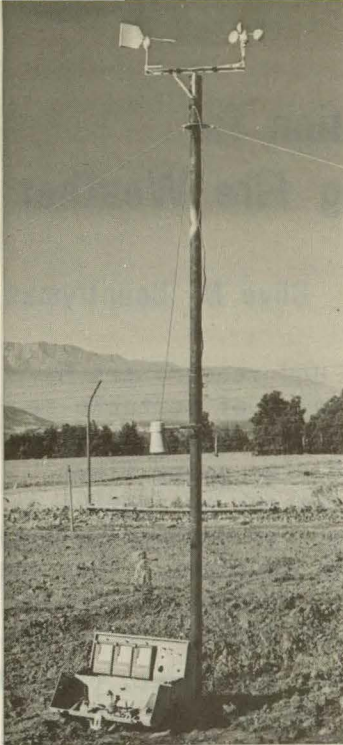
Wind speed and direction and wet and dry bulb temperatures are measured by sensors developed for fire studies.

WIND SPEED

To measure wind speed, the station uses a heat-resistant anemometer.¹ Two electrical pulses are produced for each revolution of the anemometer rotor. A frequency-to-voltage converter converts these pulses to an analog signal and averages wind speed over a pre-selected time period. The converter then feeds the signal to a recorder.

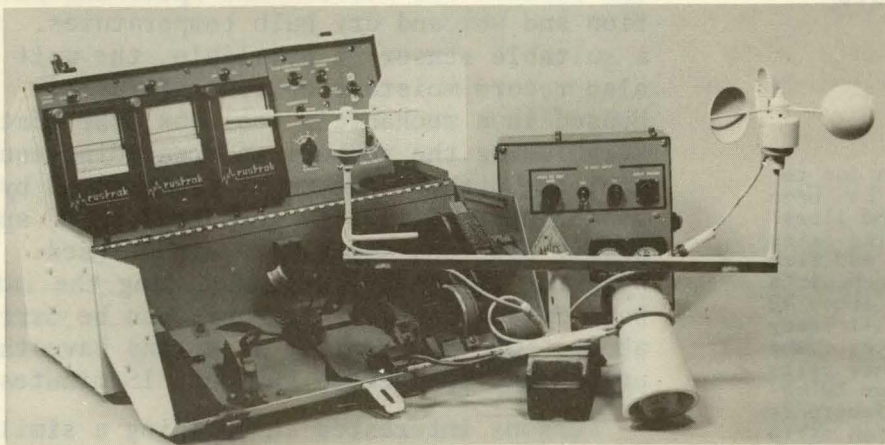


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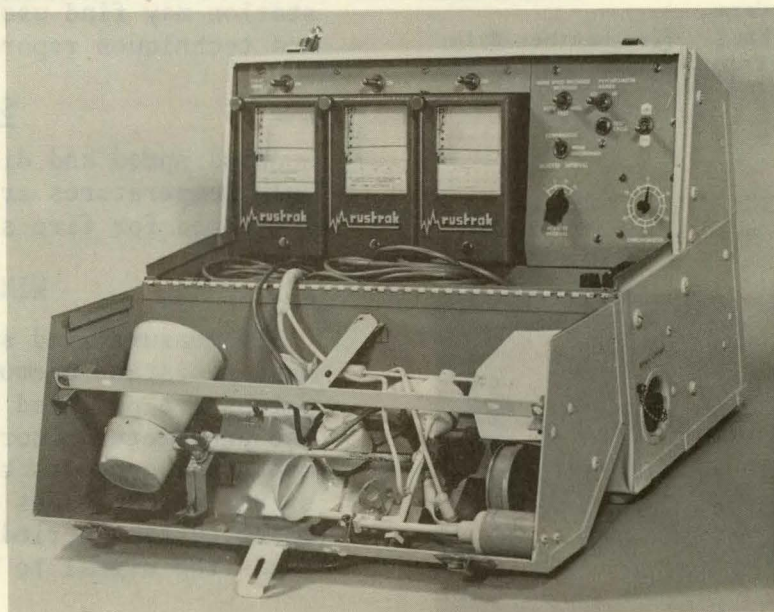


A

Figure 1.--A portable weather station (A) is set up for operation; (B) anemometer, wind vane, and psychrometer are shown assembled and ready for mounting on the mast, with the battery charger unit in the background; (C) all components of the station except the mast can fit into a tool box.



B



C

To average wind speed, the user can manually select any one of the three time periods provided--15 seconds, 2 minutes, 10 minutes--by flipping a switch on the control panel. The 15-second period permits recording detailed wind speed structure, including small gusts and peak wind speeds. The 2-minute time period smooths out some of the short-term speed fluctuations, but still leaves considerable detail. The 10-minute period provides a measure of average wind speed, but does not show the finer detail of wind speed structure.

Besides recording wind speed continuously at the selected averaging interval, the station can record it at 6-, 12-, 30-, or 60-minute intervals. The user selects the time interval by flipping a switch on the control panel to set an electric clock built into the control circuitry. Peak wind speed that can be recorded is 70 miles per hour. The recorder trace can be read to the nearest mile.

WIND DIRECTION

The station's wind direction transmitter consists of a linear potentiometer with a 350° winding. The potentiometer is placed in a weather-proof housing and mechanically coupled to a wind vane. Output from the potentiometer is fed directly to this recorder through appropriate range control circuitry. To insure accuracy of wind direction readings the voltage supply to the potentiometer is regulated to 0.01 percent per °C. The recording interval switch also controls the wind direction recording so that wind direction is obtained at the same real time as wind speed. The wind direction recorder trace can be read in about 7° increments.

WET AND DRY BULB TEMPERATURE

An aspirated, thermistor psychrometer is used to measure wet and dry bulb temperatures.² It consists of a pair of matched thermistors housed in

a radiation shield. One thermistor is covered with a cotton wick kept moist by means of a water reservoir. An electric fan at the top of the radiation shield draws air over both thermistors. To reduce any effect of water temperature on the wet bulb temperature, a portion of the wick downstream from the thermistor is left exposed to the aspirating air stream.

The psychrometer takes 60 seconds to record. During the first 20 seconds, the thermistors are aspirated to bring them to ambient air conditions. The dry bulb temperature then records for 20 seconds, followed by a 20-second recording of the wet bulb temperature. The aspirating fan is then shut off and the recorder chart allowed to run for 30 seconds to provide a separation on the chart between read-outs.

The recording-time interval switch also controls the psychrometer readout, permitting temperature readings at 6-, 12-, 30-, or 60-minute intervals. In continuous recording mode, temperature readings are 90 seconds apart. To provide better resolution on the narrow recording chart, two overlapping temperature ranges are provided. One range covers temperatures between 20°F. and 80°F., and the other range 50°F. to 110°F. The range used is controlled by a manual switch on the control panel. Temperature to the nearest °F. can be read from the recorder trace.

RECORDERS

Data are recorded by three Rustrac strip chart recorders with 50 micro-ampere meter movements. A clapper bar depresses the meter pointer every 2 seconds to mark the pressure-sensitive paper. This type of recording eliminates the problems of pens clogging in dry weather and spilled ink in transport--common to inking-type recorders.

Wind speed and direction are recorded on separate recorders. The charts on these two recorders are chronometrically driven to give time synchronization between wind speed and direction

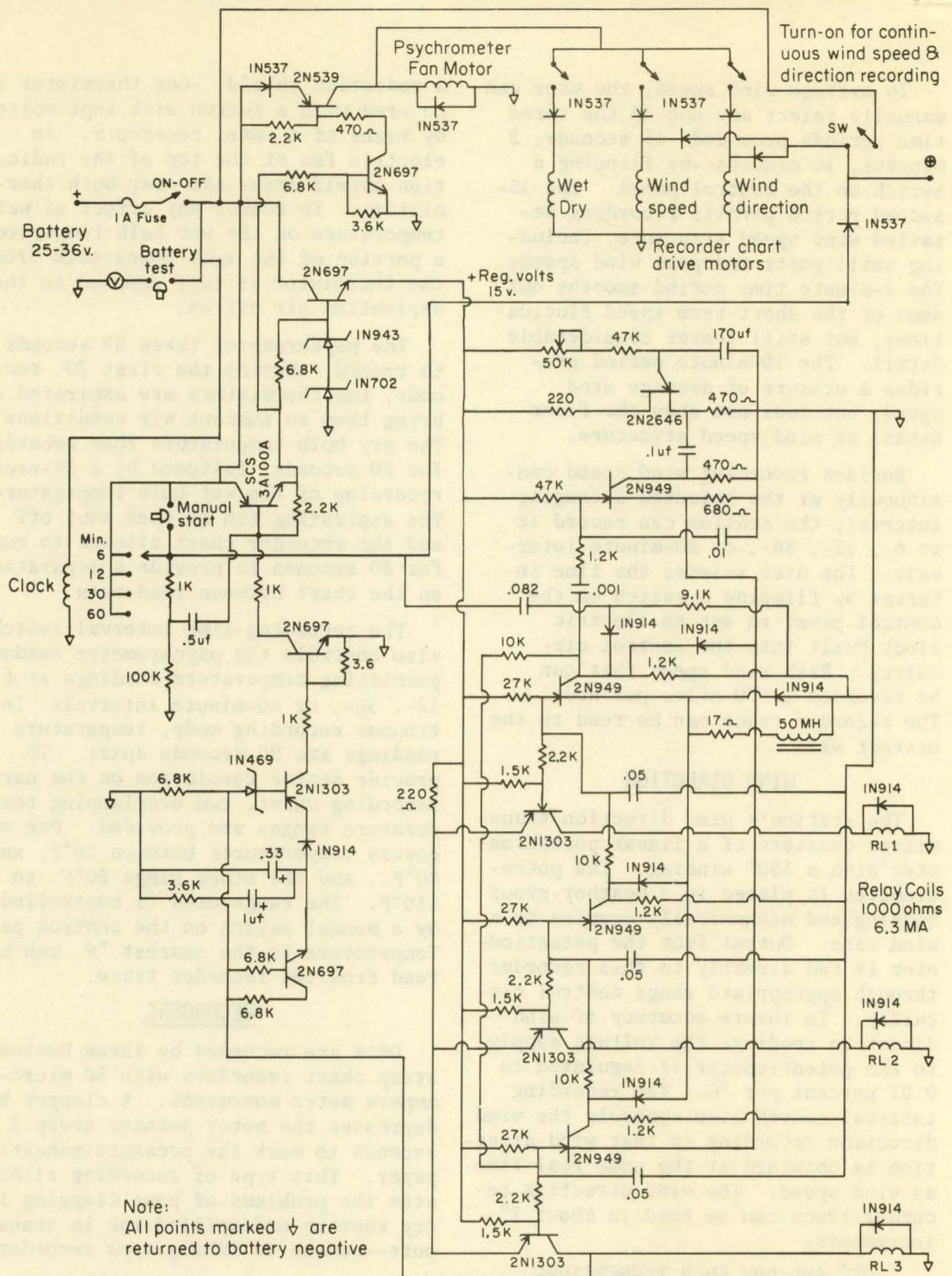


Figure 2.--(A) Control circuitry of the portable weather station;

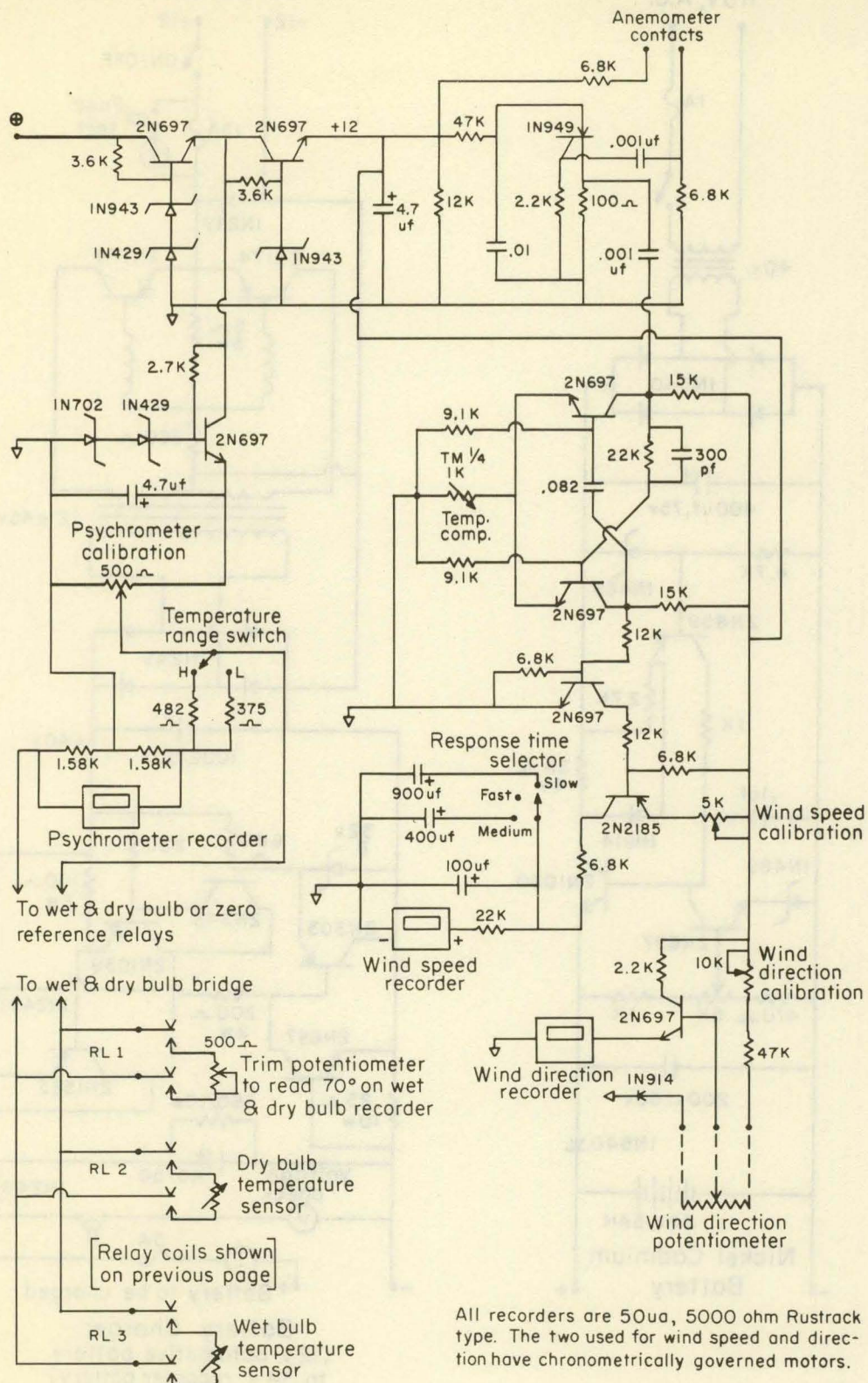


Figure 2.--(B) bridge circuitry of the portable weather station.

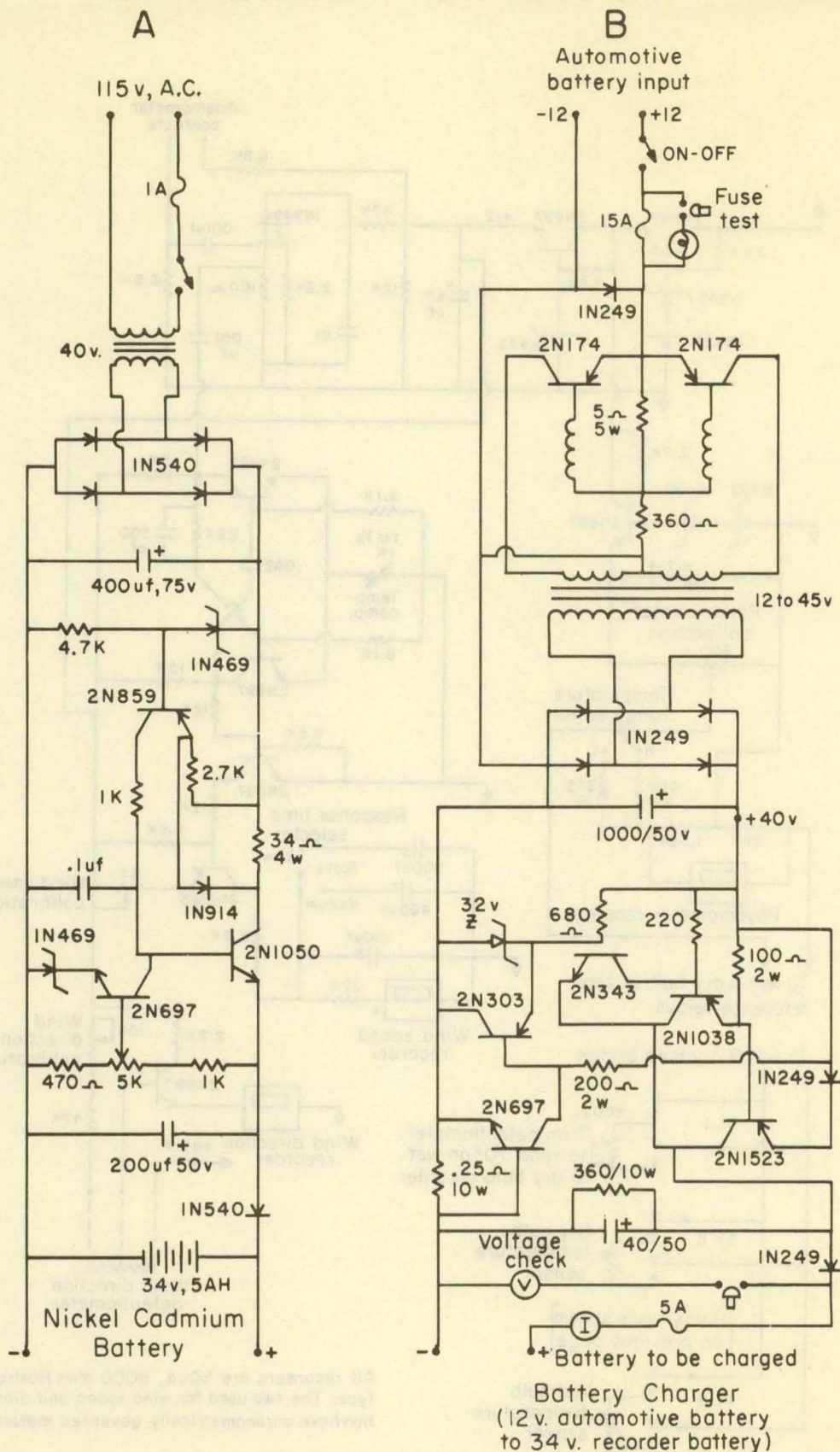


Figure 3.--Circuitry for the two types of battery charger for the weather station: (A) a battery charger is built into the unit and operates on 115 volts A.C.; (B) a power converter, housed in a separate box, can charge the battery from a 12-volt automotive battery.

records. The third recorder is used to record wet and dry bulb temperatures in sequence. Additional variables can be recorded as changes are made in the station.

A chart speed of 10 inches per hour is used for the recorders, making possible a 72-hour continuous record on a 60-foot roll of chart paper. A longer recording period is possible if the station is operated on one of the time interval modes.

ELECTRONICS

A wet cell battery (26 V., 5AH) provides sufficient power to operate the unit for about 5 days. The unit includes a battery charger designed to operate on 115 volts A.C. In addition, a power converter that will charge the battery in 2 hours from a 12-volt automotive battery was built for use if 115 volt A.C. power was not available.

The power converter is housed in a separate box. The electronic circuitry for the recording fire weather station is shown in figure 2. Circuitry for the battery chargers is shown in figure 3.

Besides the necessary controls for the sensors, a recording mode and battery condition indicator is also included. A complete readout between programed recording times can also be made.

FOOTNOTES

¹Countryman Clive M. Murray John R. Philpot. Charles W. *An electronic fire weather station*. U.S. Forest Serv. Res. Note PSW N17. Pacific SW Forest and Range Exp. Sta. Berkeley Calif. 8 p. 1963.

²Murray John R. and Countryman Clive M. *Heat resistant anemometers for fire research*. U.S. D.A. Forest Serv. Res. Note PSW 181. Pacific SW Forest and Range Exp. Sta. Berkeley Calif. 6 p., illus. 1968.

The Authors

are studying problems in mass fires and fire behavior, with headquarters at the Station's Forest Fire Laboratory, Riverside, Calif. JOHN R. MURRAY, a 1954 forestry graduate of Purdue University, joined the Station's fire research staff in 1958. CLIVE M. COUNTRYMAN heads fire behavior studies. He earned B.S. degree in forestry at the University of Washington (1939), and joined the Forest Service that same year.

