British Industries Fair.

G.E.C. Exhibit of Remote Supervisory Control Equipment.

TRADE fairs have been a feature of the world's industrial activity for many years, their scope increasing as productivity became greater and modes of transport open to potential visitors became revolutionised. Perhaps the most important event of this kind to-day is the British Industries Fair, which each year attracts visitors from all over the world. As in previous years, the 1935 Fair consisted of two sections, one of which was staged in London during the early part of the year whilst the second, designated generally as "Engineering and Hardware", recently completed a successful tenure of a site near Birmingham.

The General Electric Company occupied one of the largest stands in this second section and displayed a selection of a wide range of products, special interest being manifest by visitors in the exhibit of remote supervisory control equipment. Whilst there is no doubt that a proportion of the interest was attributable to the fact that the exhibit was in actual operation, it became clear during the course of the Fair that there is a growing realisation of the important part played by remote supervisory control in undertakings of all kinds.

The object of the exhibit, a general view of which is shown on page 26, was to illustrate the application of remote control to a variety of purposes, of which Power, Light and Heat were taken as examples. The three applications were treated individually and were represented by a model water undertaking together with its associated control panel on the left of the stand ; a floodlighting system in the centre background, controlled from the panel in the centre foreground ; and an electrode boiler on the extreme right controlled from a third panel.

In the course of each demonstration it was explained that the separation of a control panel from the equipment with which it was associated represented the distance, which might be several miles, separating the central and distant stations in actual practice, the various control functions being effected from the control panel over four pilot wires to the "distant" point.

In common with other G.E.C. remote control apparatus the exhibits employed telephone type uniselectors and relays actuated in response to circuit conditions established by the operation of keys on the control panels. It is a feature of G.E.C. equipment that when a key is operated, uniselectors and relays at the control and distant points first select the apparatus to be actuated at the distant point and then give a "check-back" signal to denote that this selection has been correctly carried out. On

receipt of this signal the attending engineer depresses a common "operate" key to cause the actual function to be performed. The assurance provided by the check-back signal is an advantage which interested visitors were quick to appreciate.

The three sections of the exhibit are described separately under their respective headings.

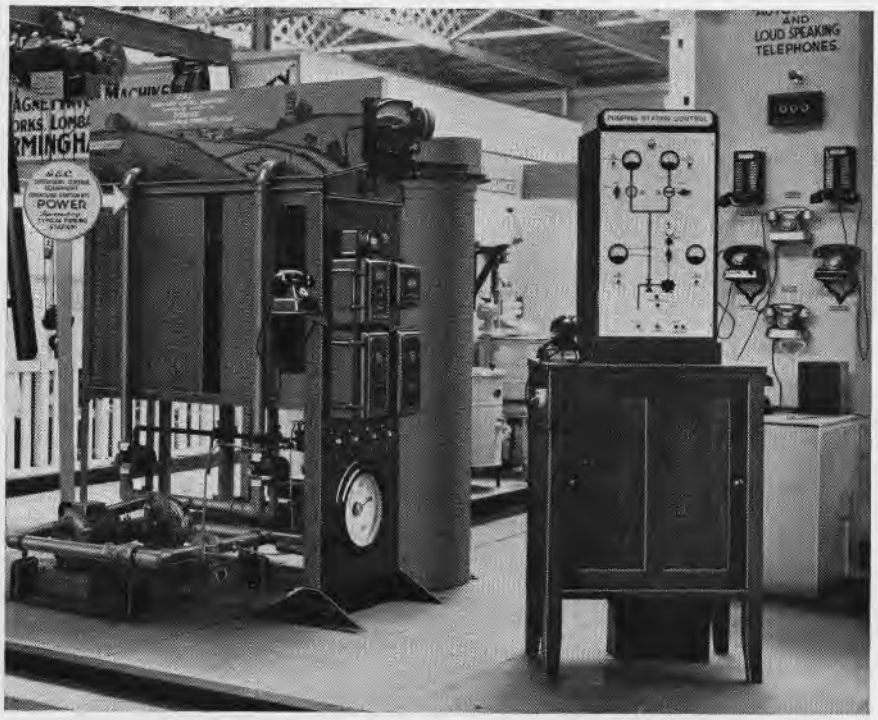

Fig. 1.—Power control.

Power.

A coloured painting on canvas representing a typical layout with a water tower in the background, a reservoir on the left and a pumping station in the foreground, lent a realistic touch to the "Power" exhibit shown separately in Fig. 1. From a mains supply, a pump, corresponding to the pumping station, fed water through motor-operated valves to either of two tanks, corresponding to the tower and reservoir respectively. Control of such a system required that provision should be made for starting and stopping the motor, opening and closing the valves, indicating water level and rate of flow. Local control was obtained in the usual manner by means of meters and ironclad switchgear mounted on a switchboard adjacent to the tanks. Remote control was obtained from the control panel on the right, by means of which, in addition to the main control functions already referred to, complete supervision was obtained by designing the remote control apparatus to (a) denote whether the motor was running or idle; (b) denote whether valves were open or closed; (c) indicate motor current; and (d) give an alarm if the temperature of the motor windings became excessive.

Whilst in actual practice additional facilities could be provided, such as indication of water pressure, the range provided in the equipment on the stand was sufficiently comprehensive to demonstrate the capabilities of remote supervisory control as applied to such an undertaking.

On the control panel appeared a representation of the undertaking in the form of a mimic diagram, in which the pipe lines, tanks, valves, flow-meter, pump and motor were readily recognised. The purpose of

keys and lamps incorporated in the mimic diagram, was quickly appreciated by virtue of their position in the diagram. Thus, the water level of the tank corresponding to the reservoir and represented by the meter on the top left, was read on this meter by throwing the adjacent key, waiting for the check-back signal and then depressing the common "operate" key at the bottom of the panel. Similarly, the level of the tank corresponding to the tower was read on the meter on the right.

Beneath the meters (Fig. 1) are seen discs which were rotated by means of simple electro-magnetic mechanisms to complete the pipe line as shown on the left, denoting that the corresponding valve was open, or to break the line, denoting that the valve was closed. The valves were operated by turning keys, positioned near to the indicator, either vertical to open the valve or horizontal to close it. In each case depression of the "operate" key to start the small motors operating the valves was delayed for a moment until the check-back signal was received on the lamp adjacent to the appropriate indicator. If the pump motor was at rest it was started by turning its associated key to conform with the line representing the A.C. mains supply, waiting for the check-back signal on the smallest of the three lamps above the key, and then depressing the "operate" key. When the motor attained speed, a red lamp glowed above the associated key. Alternatively, to stop the motor, this key was turned to a position at right angles to the A.C.-mains line, the "operate" key being depressed after the check-back signal had been received. With the motor idle, the red lamp was extinguished and the green lamp glowed, these two lamps giving continuous indication as to whether the motor was running or not. A reading of motor current was obtained on the meter at the right of the motor key by throwing the "select" key beneath the meter and then depressing the "operate" key, the check-back signal intervening. Similarly a reading was obtained of water flow on the meter shown connected to the venturi pipe.

A demonstration consisted of first obtaining water level readings, a low reading on, say, the meter on the left denoting that a fresh supply should be pumped to the tank corresponding to the reservoir. The motor was started and, after speed was attained, the appropriate valve was opened. After throwing the key adjacent to the flow meter and holding the "operate" key depressed, the increasing rate of flow was indicated on the meter as the valve moved from the closed to the fully-open position.

If any change occurred at the pumping station, either due to a fault or to deliberate action in the course of a demonstration, indication of such change was at once given on the control panel at the central station.

The whole of the control and supervision was effected over the four pilot wires between the control point and the pumping station, a pair of these wires being employed for telephone communication also. Either telephone, shown in Fig. 1, could be called from the other merely by lifting the handset and pressing a button fitted in the normal dial aperture. Whilst conversation was in progress, normal control and supervision were not interfered with.

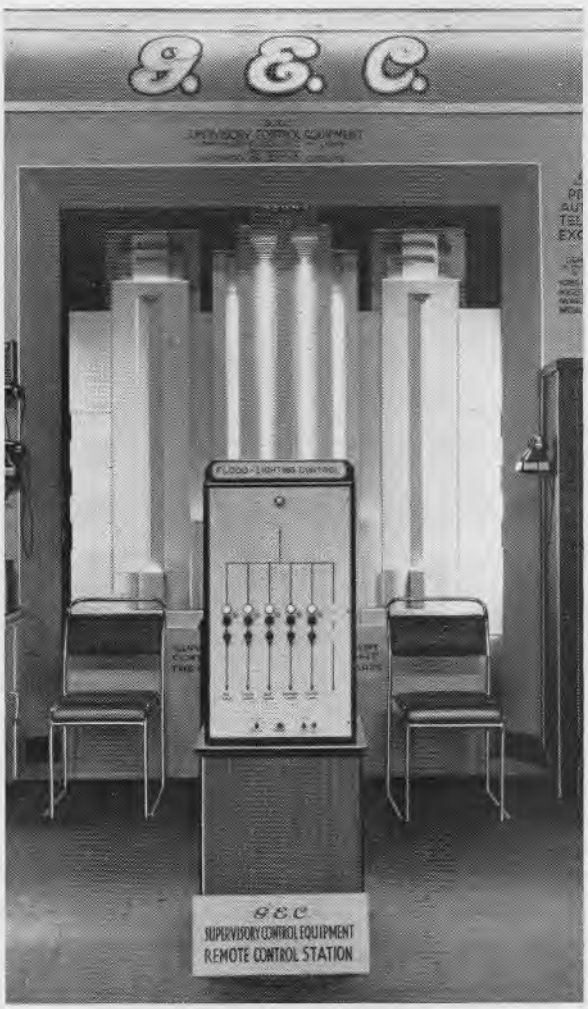

Fig. 2.—Light control.

Light.

Although the exhibit of remote supervisory control as applied to "Power" aroused considerable interest because of its moving parts, it was the floodlighting section which, by its appeal to the eye, attracted principal interest. A facade of a type which lent itself well to floodlighting was inset in the main structure of the stand, behind which were concealed sets of Osira lamps, a set positioned vertically on the left giving green lighting, one vertically on the right giving red, and a third, horizontally across the base, casting a blue light. In the centre of the facade itself were four striplights, whilst built in at suitable points were small lamps giving concealed lighting.

A variety of very pleasing effects was obtained by controlling the lighting from the remote control panel seen in the foreground in Fig. 2. Here again a mimic diagram simplified the procedure by associating keys and lamps with their particular purpose. Any given set of floodlights was selected to be switched on or off by means of the appropriate key, the actual switching following depression of the "operate" key at the bottom of the panel. In Fig. 2, above each key associated with the floodlights are seen three lamps, one of which gave the check-back signal, one (green) glowed to indicate that the floodlights were switched off, and the third (red) glowed to indicate that the lights were switched on.

Heat.

The third section, seen separately in Fig. 3, was also of an extremely practical nature, and consisted of an electrode boiler together with local and remote control equipment. The boiler was of the type intended to serve as a storage heater and often installed to provide off-peak loads. In these boilers the water itself is used as a conductor, the potential difference across it being applied by means of electrodes consisting of a number of vanes. One set of vanes is fixed, the other being mounted on a shaft driven by an electric motor through a reduction gear. By rotating this shaft through a limited arc, the position of one electrode is changed with respect to the other and the loading of the boiler is correspondingly varied.

In view of its impracticability no attempt was made to dissipate the heat the boiler was capable of generating and thus it was possible to open one end to disclose the vanes. A cubicle adjacent to the heater accommodated contactors and local control gear, a cast-iron case mounted on the side housing the uniselectors and relays forming the remote control equipment at this point.

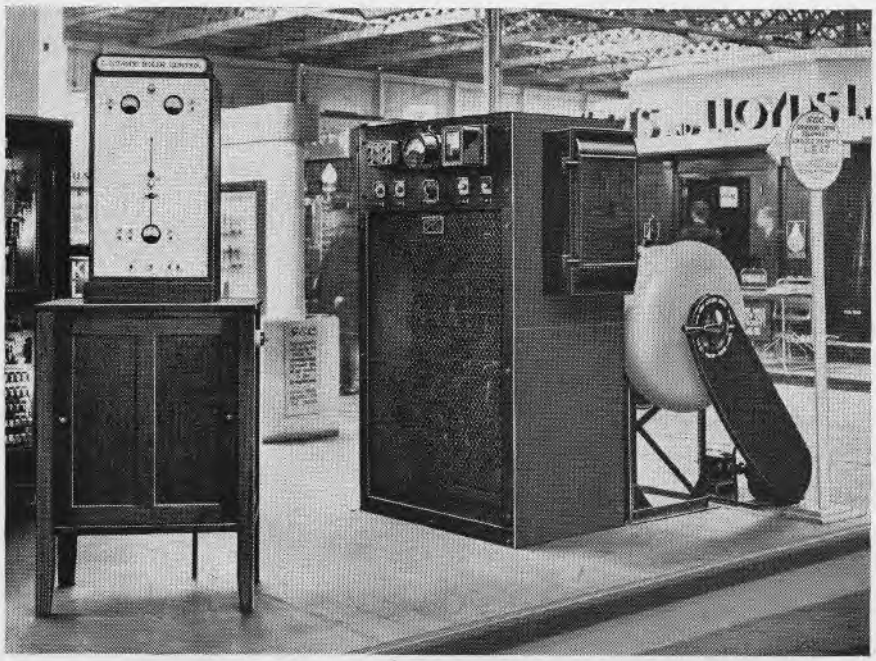

Fig. 3.—Heat control.

To control the boiler it was necessary to (a) indicate water temperature; (b) indicate K.W.H. taken by boiler over a period; (c) open and close A.C. mains supply to boiler; (d) indicate load current; and (e) start and stop the motor operating the movable electrode. A simple mimic diagram incorporated a key controlling the main supply, together with a meter representing the boiler itself and denoting, on demand, the K.W.H. consumed. Two lamps above the key gave continuous indication of whether the mains supply was switched to the boiler, green indicating "off" and red "on", whilst a third lamp gave the usual check-back signal. Of two meters at the top, one on the right indicated temperature, that on the left indicating load current, a reading of either being obtained by throwing the appropriate "select" key and then depressing the "operate" key exactly as already explained. Two keys, with check-back lamps, at the left of the K.W.H. meter enabled the load to be raised or lowered at will, since depression of either key followed by depression of the "operate" key caused the motor to start, the direction of rotation depending upon the key selected. Whilst the "operate" key was held depressed the motor continued to run and the increasing or decreasing load was shown on the ammeter. Since the boiler was not charged with water, an artificial load was employed in order to permit these load readings to be obtained.