REMOTE CONTROL DESKS

('TIGER' CLASS CRUISERS)

BY

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Readers may have read an article by Commander E. Tyrrell, R.N., A.M. MECH.E., M.I.MAR.E., entitled 'Automatic and Remote Control of Steai Turbine Machinery' which appeared in Vol. 9, No. 1 of the *Journal.* Followin this general review, it may be of interest to consider one aspect in greater deta —the machinery control desk in the machinery control room to be fitted in th *Tiger* Class cruisers at present under construction.

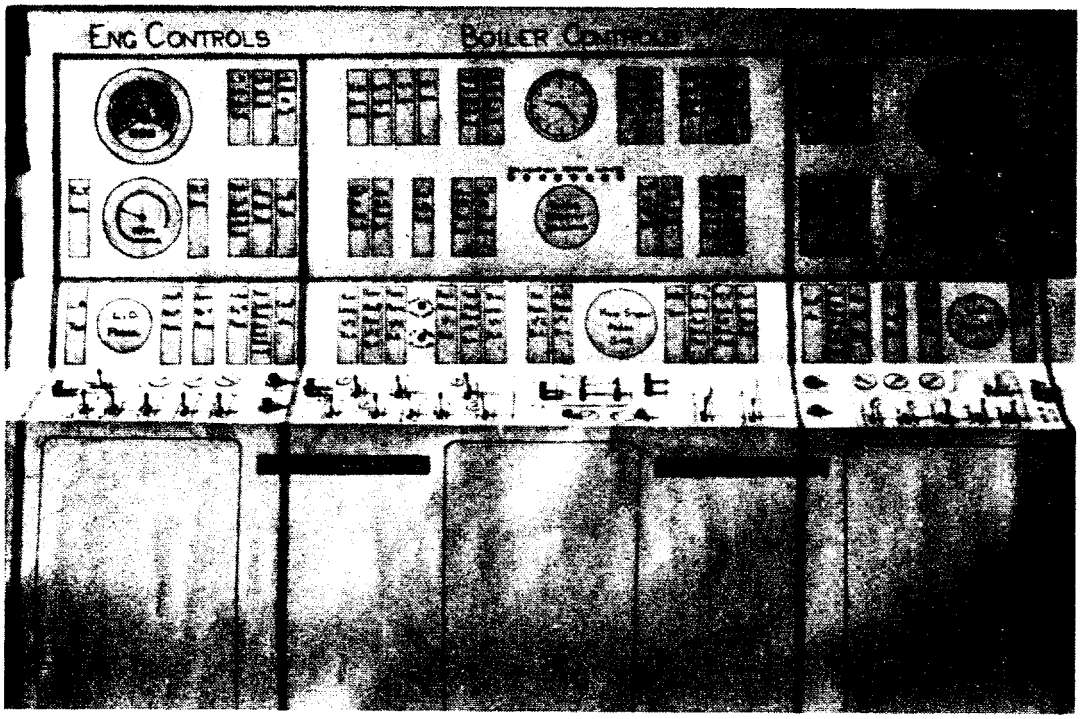

FIG. 1—CONTROL DESK MOCK-UP

The design is based on the decision that machinery control rooms should be used to the fullest extent possible to familiarize watchkeepers with the remote control arrangements fitted to combat A.B.C. warfare. To this end, the normal operation of machinery, from the 'stand-by' to 'full power' conditions, is incorporated, including manœuvring. This does not mean, however, that there will be no watchkeepers in machinery spaces during normal steaming, but that standing watchkeepers will be replaced by patrols operating from the M.C.R. as the nerve-centre. These patrols would be withdrawn during A.B.C. attack, the machinery being left unattended for a short period. The 'patrol watch' conception should, with experience, make available more personnel for maintenance duties.

In order to achieve a satisfactory layout for the control desk from the point of view of operational requirements, a full-scale mock up was constructed in E.-in-C.'s Department with outline shapes of the instruments required pinned in the positions considered most suitable. Naval officers in the Department were then invited to view the panel and offer criticisms or ideas for improvement from the following aspects :—

(*a*) Grouping of controls and associated gauges

(*b*) Unnecessary controls or gauges

(*c*) Addition of controls or gauges

(*d*) Use of circular versus edgewise gauges.

General Arrangement of Desk

Each ship has two machinery control rooms, situated one in each engine room. Lack of space restricts their size to 15 ft × 8 ft × 8 ft and, in turn, the panel size to about 10 ft 6 in. × 6 ft × 2 ft. It was decided, therefore, that, except in certain special cases, all gauges were to be of the edgewise type.

Each control room has control over one unit, comprising a boiler room with two boilers and an engine room with two sets of main engines.

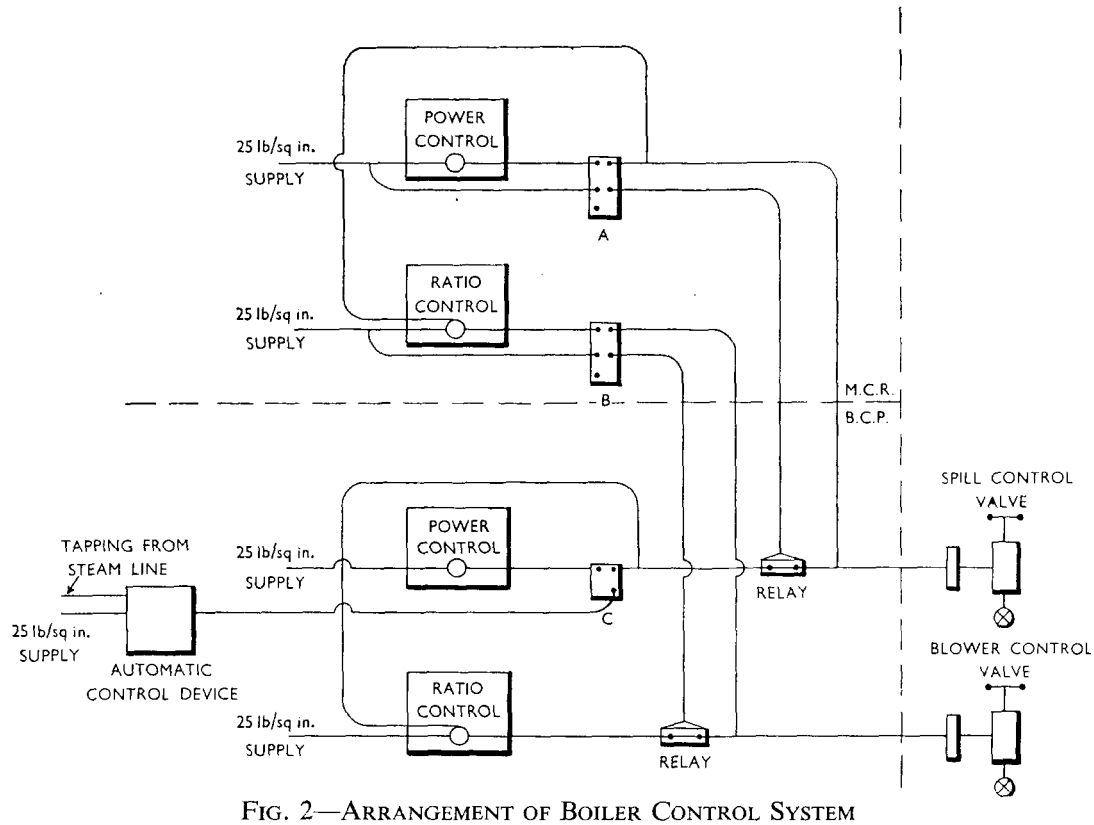

FIG. 2—ARRANGEMENT OF BOILER CONTROL SYSTEM

As can be seen from FIG. 1, the panel is divided into three sections, each to be operated by one rating, i.e. boiler controls in the centre with engine controls at each end, one engine panel being a mirror image of the other. The boiler section is further subdivided into water controls and oil controls with blower and sprayer controls in the centre. Although at one stage the subdivision was to have been between No. 1 and No. 2 boiler controls, the present arrangement was agreed because this enabled a water tender to be brought to the panel under extreme manœuvring conditions, leaving the normal operator free to tend the power controls.

The panel is also divided into four sections vertically, the lower containing control levers, push buttons, etc., the remaining three, gauges and indicators, the most important being immediately above the controls. It should be noted that the feed system is included on the boiler panel, although several of the equipments are in the engine rooms, because it is considered more logical that the Ch.M.(E) should have control of the feed water when in remote control.

Controls

For reasons given by Commander Tyrrell in his article, these are pneumatic, operated by L.P. air at 100 lb/sq in. One compressor is fitted in conjunction with the controls fitted in each unit, with an H.P. air bottle and reducing valve to provide an emergency supply.

BOILER PANEL

Fuel and Forced Draught

The fuel system is of the spill type, the main burners being supplied through a spill control valve for each boiler by a two-stage turbo driven F.F.O. pump

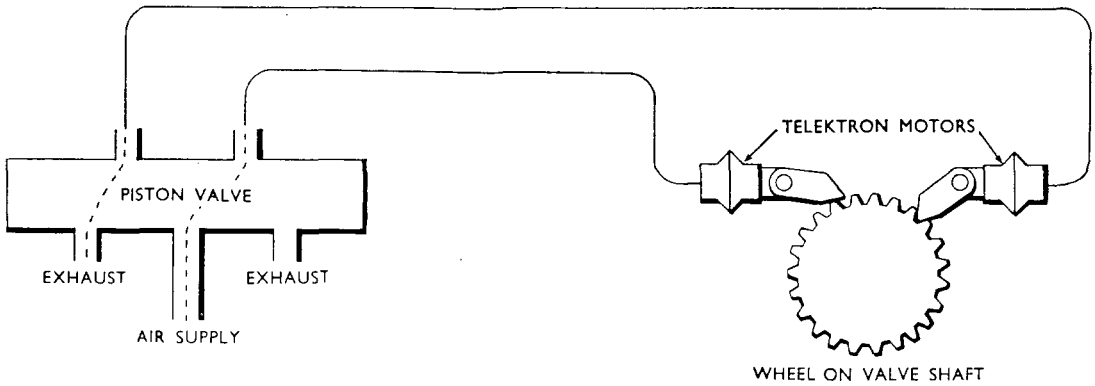

FIG. 3—ARRANGEMENT OF VALVE CONTROL BY TELEKTRON MOTOR

and the pilot burner supplied by a motor driven dieso pump at 200 lb/sq in. Each pump is capable of supplying two boilers at full power. Duplicate pumps are fitted for stand-by duty. There are two turbo driven blowers per unit discharging through trunking into either (or both) boiler casing.

For the purpose of remote control, the two spill valves are combined through one control ; similarly, the two blower throttles. The operation of the valves is by air motor geared to the valve spindle. The arrangement of the system is shown in FIG. 2. From this, it will be seen that the system comprises remote manual control of fuel and air from either the machinery control room or the boiler control position in the boiler room. M.C.R. or B.C.P. control of both air and fuel is selected by operation of levers A and B.

To provide a certain degree of automatic operation, the fuel and air controls have been linked so that adjustments to the fuel (power) control automatically adjust the air control. This has been arranged so that, for power increases, the air control leads the fuel control and, for decreases, the air adjustment lags behind the fuel control. A further step along the road to automatic control has been taken by the provision of a simple feed-back for the steam range pressure to adjust the power control as necessary. This addition is for control while steady steaming, and is purely to provide experience.

Gauges connected with the system are steam pressure (line), boiler casing air pressure, smoke density meter and boiler drum pressure. It is intended that the operator should work from the steam pressure (line) gauge and the smoke density indicator, with the air casing pressure gauges as initial, rough, secondary sources of information.

Boiler drum gauges are incorporated to enable lighting-up to be supervised from the M.C.R.

Remote operation of the two F.F.O. service pump throttles by Telektron motors is also provided, the air being directed to the required motor for opening or closing by a lever-operated piston valve situated on the control desk as shown in FIG. 3. Remote operation of the F.F.O. quick closing shut-off valves was also, at first, provided, but it was later decided that, for an emergency valve of this nature a servo system was fundamentally unsound and it has now been replaced by rod gearing to the main deck and boiler-room plates only.

Remote stop pushes for the motor driven dieso pumps are incorporated, but remote starters are not considered necessary since the failure of these pumps would not immediately effect the running of the ship. Gauges fitted in conjunction with the system are No. 1 and No. 2 F.F.O. service pump discharge pressures, dieso pump discharge pressure and O.F. service tank levels. Both

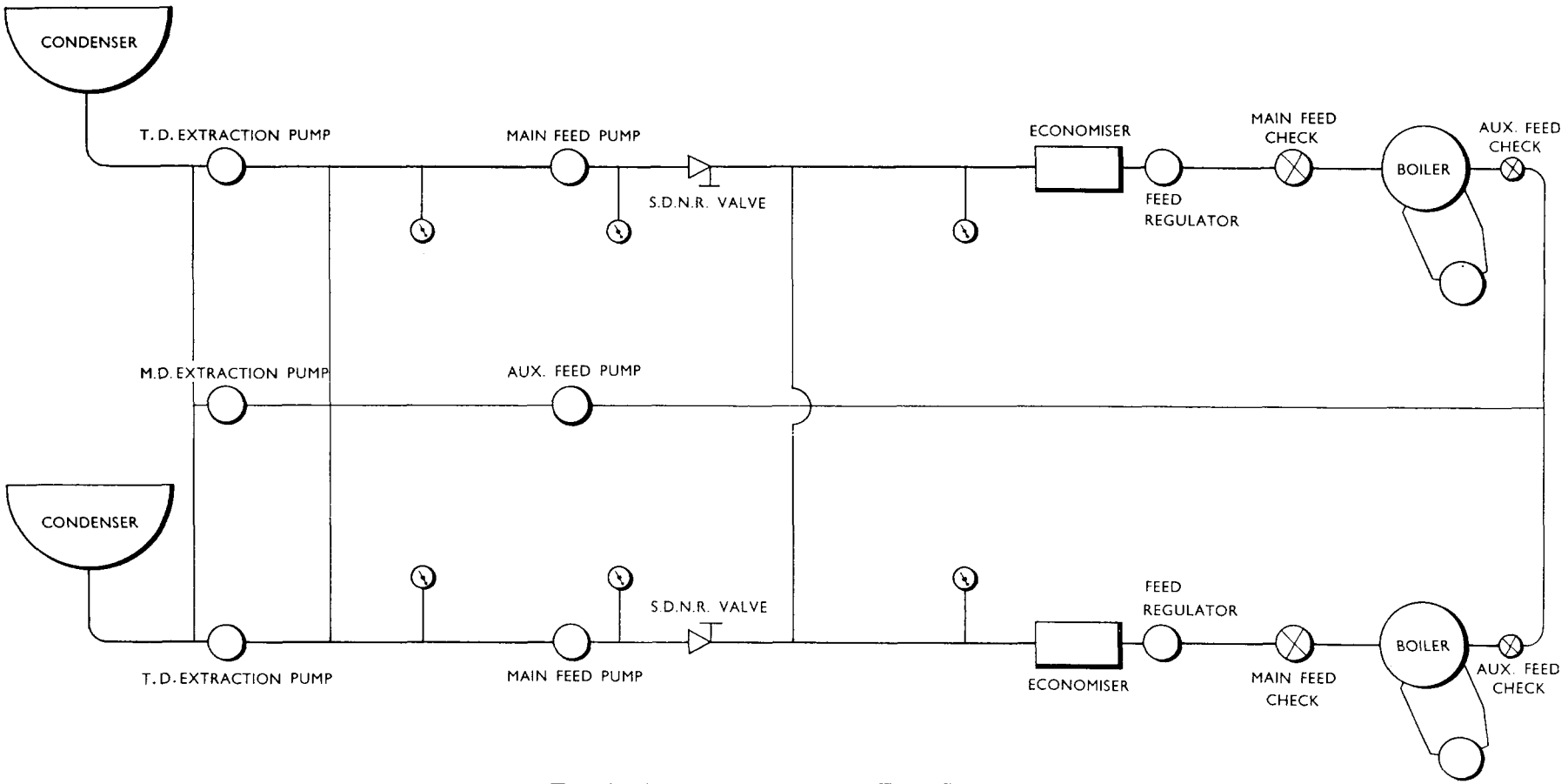

FIG. 4—ARRANGEMENT OF THE FEED SYSTEM

automatic and remote manual control of F.F.O. temperature, which can be set to control at any temperature between 170 degrees F. and 250 degrees F. are also incorporated.

It was the original intention that remote manual control should be possible from either the boiler room or the M.C.R., but it was later decided that, since the only failures likely to occur in the automatic system were air failure or instrument failure and would also effect the manual system, manual control from the M.C.R. was not required and a temperature gauge only was fitted.

Feed System

The basic feed system as fitted in these ships is shown in FIG. 4 and control by Telektron motor and piston valve as for the F.F.O. pump throttles is provided for the main and auxiliary feed pump throttles and the main and auxiliary feed checks.

It will be seen from FIG. 4 that if pressure gauges were fitted on the main feed pump side of the S.D.N.R. valves it would not be possible to see if both these valves were open, and similarly, if the gauge was sited on the other side of the valve, it would not be possible to see if both pumps were running. The gauges fitted, therefore, are from extraction pump discharges, main feed pump discharges before S.D.N.R. valves, and main and auxiliary feed pressures before feed check valves, as shown. In addition, as it is present policy to fit three methods of boiler water-level remote indication, it has been decided that in addition to Igema gauges sited elsewhere, air-operated level indicator and feed regulator balance-chamber pressure gauges should be fitted on the panel.

Topping up the main feed tank from reserves is controlled by a diaphragm-operated valve known as the R.F.T.-overflow tank run-down valve. This admits water to the overflow tank whence it is pumped to the M.F.T. by the feed transfer pump, which is automatically started by a float-operated switch.

Stop and start pushes for the motor driven extraction pump are sited on the desk and other gauges and indicators are :—

(*a*) Main and auxiliary feed check position indicators.

(*b*) M.D. extraction pump ' running ' and ' power available ' lights, the latter being necessary to indicate availability of each of the three phases of the A.C. supply, because serious damage will result from operation on one or two phases.

(*c*) Feed transfer pump-running light.

(*d*) Salinometer light repeats from the machinery space salinometers.

(*e*) Main, overflow and reserve feed tank level gauges.

(*f*) Main feed tank low-level warning light. This is considered desirable, in addition to the level gauge, as a positive indication should an excessive fall in level not be noticed from the gauge.

(*g*) Feed temperature after heater, which is included to indicate satisfactory operation of the feed heater drain system.

ENGINE PANELS

Manoeuvring Valves

As cruising turbines are fitted in *Blake* and *Defence*, an interlock is fitted to prevent operation of the cruising throttle when the ahead throttle is open and vice versa. The engaging-disengaging operator for the cruising turbine clutches is linked to the throttle interlock and thus operation of this lever will disengage

the cruising turbine. To encourage the ships staff to use the control room under cruising conditions it was decided to incorporate remote operation of the throttle interlock to de-clutch only. Remote engagement of the cruising turbine was not incorporated since this would have caused excessive complications (opening emergency valves, setting trip gear, etc.). The remaining ship (*Tiger*) has full power and cruising nozzles on the H.P. turbine only, and hence this interlock is not fitted.

Individual control of each of the three throttles by Telektron motors is also arranged with a master shut-off valve isolating the air supply from the system. This valve was incorporated as a precaution against any of the throttle control levers jamming, in which event the throttle would have continued opening or shutting, depending on the setting of the lever. Fast or slow movement of the throttles may be selected by depressing the control lever sideways before operating.

Gauges and indicators fitted in this system are :—

(*a*) Ahead, astern and cruising receiver pressure gauges.

(*b*) Main steam pressure from the engine side of the bulkhead valve, which enables the engine controller to follow the boilers.

(*c*) Manœuvring valve position indicators, the need for which was the subject of a very wide variety of ideas. Experience in *Ark Royal*, whch showed them to be of considerable assistance, finally decided the issue. The indicator is designed to show both the ' turns open ' and small movements of the throttle for watchkeeping.

Turbine Drains and Feed Controller By-Pass

To enable the control room to be used under manœuvring conditions, control of turbine drains is obviously essential. The drains are combined into two sets, H.P. and L.P., each operated by one diaphragm valve. These valves are in turn controlled by one piston valve on the panel. It was later decided that control of the feed controller by-pass valve was essential and, owing to lack of space on the desk at this time, it was included as a third valve operated by the same lever as the turbine drains, it being agreed that normally, with drains open, the by-pass would be closed and vice versa. To enable the controller by-pass to be opened with the drains open, or closed with the drains closed, an additional hand operated by-pass is fitted in parallel.

Lubricating Oil System

A system of automatic and remote manual control of lubricating oil temperature was included, similarly to that for F.F.O., but, for the same reasons as stated for the F.F.O., the manual control from the control panel was eventually omitted.

Although there is an automatic cut-in device for the stand-by motor-driven lubricating oil pump to guard against failure, remote stop-start pushes are also fitted. These also enable the watchkeeper to run up the pump whenever required.

The gauges and indicators fitted are the M.D. pump running and power-available lights, the lubricating oil tank level indicator, the oil temperature gauge and the oil pressure gauge, which, being of primary importance, is circular.

Other gauges, etc., fitted on the panel for information include :—

(*a*) Condenser vacuum and temperature ; feed controller pressure; in addition, condenser level was also considered, but was omitted in favour of feed controller pressure which would also indicate sticking of the float.

(*b*) Gland steam pressure
(*c*) Auxiliary superheated, saturated and exhaust steam pressures
(*d*) Circulating water pressure to auxiliaries
(*e*) L.P. turbine inlet temperature and pressure
(*f*) L.P. air pressure (both G.S. and remote control)
(*g*) Telegraphs and r.p.m. indicators
(*h*) Engine and revolution order reply gongs.