

XI. CONTROLLING APPARATUS

XI.1. CONTROLLING APPARATUS

Development of the super-small sized contactors and switches of excellent performance being advanced, novel designs are drawing attention of various quarters. Fig. XI.1 shows one of them—a magnetic switch to be attached to the motor protecting relay. Though this magnetic contactor is regarded as one of the most excellent products of its performance, it is extremely small sized and its electrical life of the contacts for switching on and off is good for more than 1 million times operations, its mechanical life more than 10 million operations. That is, it conforms to the JIS standard class A (capable of switching on and off the current of ten times as many as the rated current of the maximum applicable capacity of motor) and to No. 1 (capable of switching on and off 1.200 times per hour), thus electrical and mechanical life conforming to the first rank product housed in dust, corrosion and explosion-proof case are also manufactured. Besides, RCb 3930 III and RCb 3939 III R have been developed as one of this series (Fig. XI.2).

The maximum applicable capacity of these motors is as follows :

RC 3931-I	220 V	5 HP	440 V	4 HP
RCb 3930 III	220 V	15 HP	440 V	15 HP

In thermal relays, there are RC 3737-I of semi-direct heating type (Fig. XI.3) and RC 3737 II (Fig. XI.4) of indirect heating type, the latter, being so designed as to have a long trip time within the range allowed for protecting motors, is most suitable for the protection of motors which have a load of a large moment of inertia or are to be started and stopped with extreme frequency. Since every one of these thermal over-load relays is provided with the room temperature compensation equipment, it has a feature of always being capable of protecting a fixed overload of motors.

As for short circuit protecting relay, a super-small sized one has been developed as shown in Fig. XI.5 RC 3737 model. Fig. XI.6 show K-138 control switch, small-sized and of excellent performance, working on a principle of a cam operated type. Combined with elements, it can operate to control direct starter for a cage motor (220 V 5 HP), a star delta starter (220 V 7.5 HP) and others. Its electric life of contacts is good for over 1 million operations. Fig. XI.7 shows K 244 g type end limit switch, its electric life of contact being over 5 million at a-c 1A, over 10 million at d-c 20 watt,

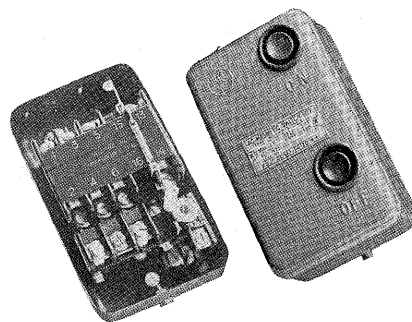


Fig. XI.1a. Magnetic Switch Type RC 3931-I

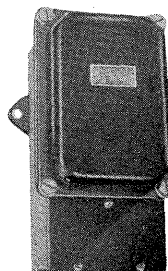


Fig. XI.1b.
Gastight Magnetic
Switch RC hg 3931-I

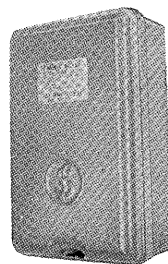


Fig. XI.2.
Magnetic Switch
Type RCb 3930-III

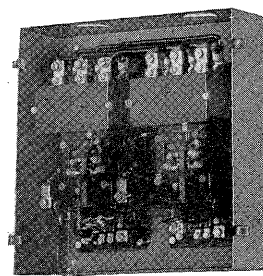
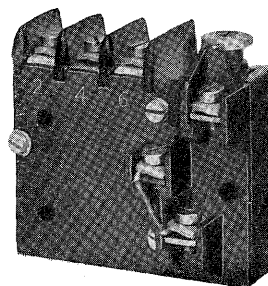


Fig. XI.3.
Thermal Overload
Relay
Type RC 3737-I



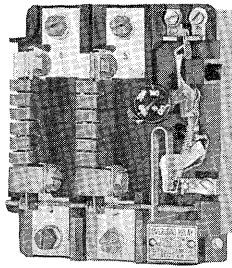


Fig. XI.4.
Thermal Overload Relay

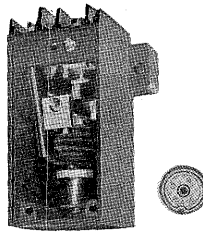


Fig. XI.5.
Short Circuit Protecting Relay
Type RC 3737

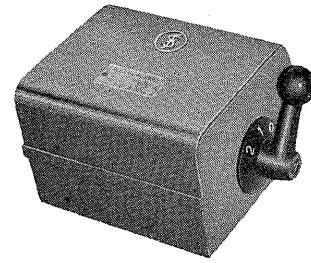


Fig. XI.6.
Control Switch

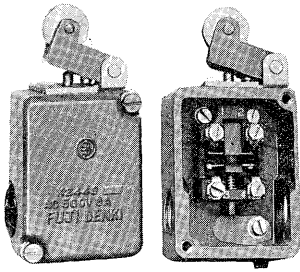


Fig. XI.7.
End Limit Switch
Type K 244g

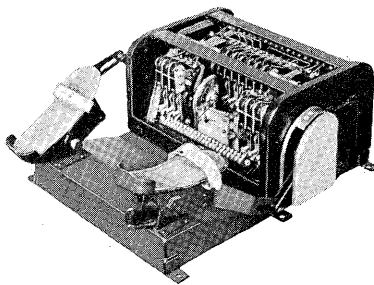


Fig. XI.8.
Master
Controller

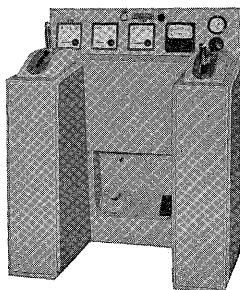


Fig. XI.9.
Control Desk for
Electric Winder

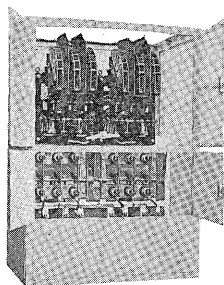


Fig. XI.10.
High Tension Reversible
Magnetic Contactor

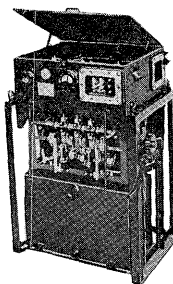


Fig. XI.11. High Tension Oil
Immersed Magnetic Switch Box
(Explosion Proof Type)

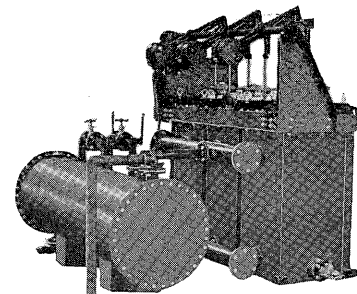


Fig. XI.12.
Liquid Rheostat for 600 kW

Fig. XI.8 shows a foot operated controller to control a main motor of Ilgner control for the blooming mill. It can operate 8 steps of normal and reverse control by using 4 steps of voltage control and 4 steps of motor field control. This master controller is also so designed as to be able to control both feed roll motors and front and back table motors.

Fig. XI.9 shows a control desk for controlling 2×700 HP motors for inclined course winder, and a high tension contactor for main circuit to be operated by it is shown in Fig. XI.10.

Fig. XI.11 shows an oil immersed explosion-proof contactor box with thermal relay to be used for automatically controlling a pump motor in coal mine being rated at 3,300 V, and 100 A.

Fig. XI.12 shows a liquid rheostat of a new type having a such construction that its cylindrical electrode goes up and down in a porcelain cylinder, and alkali-proof rubber lining is employed in a liquid tank with a feature of very long life. Its maximum applicable capacity to a motor is 600KW as an induction motor.

Fig. XI.13 shows an external view of the short circuiter available for protecting contacts of contact rectifiers; its closing time is 1.5/1,000 sec. max. handling closing current 100 KA at the maximum.

Fig. XI.14 shows a motor operated cam type switch manufactured as an automatic compensator starter or a condofar starter of cage rotor induction motor. It can be adjusted as to its starting time at will; the maximum applicable capacity of motor being 40 HP at 440 V.

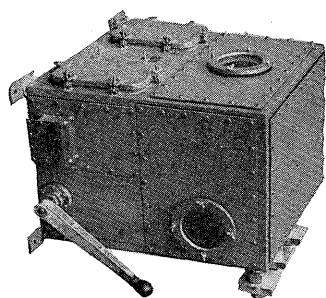


Fig. XI-13.
Short Circuitter for
Contact Rectifier

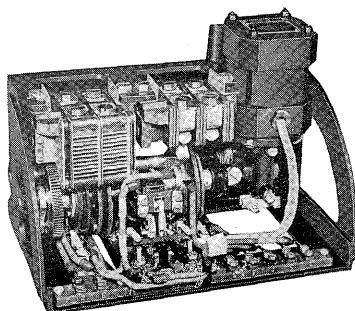


Fig. XI-14.
Motor Operated Starting
Compensator

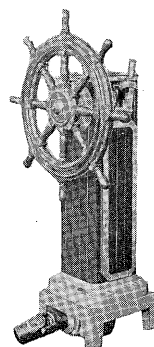


Fig. XI-15.
Motor and
Mechanical
Steering
Controller

XI-2. ELECTRICAL STEERING ENGINE

The Screw-drive Steering Engine, type MSS-I, employed aboard catcher boats since 1950 has been showing excellent results. Catcher boats sailing about the rough waters of the Antarctic zone demand of their steering engines a severer service than ordinary ships.

But none of steering engines of this type hitherto supplied have failed to keep up with their requirement under such a circumstance. This type of steering engine was manufactured for the first time to be mounted on a Japan's first thoroughly electrified catcher boat of 420 ton, having the rating of maximum twisting moment 6 TM motor 12 HP, whole rudder angle 70 degree, whole angle steering time 10 seconds. In compliance with the demand based on the experience in whole hunting in the Antarctic Ocean, the catcher boats of nowadays are becoming year after year larger in their size and faster in their speed. And for this sake, the steering engines are required to increase their capacity; for instance: 11 TM-18 HP-10 sec. for 600 ton boat, 12 TM-20 HP-10 sec. for 650 ton, etc. These machines, with the increase of the capacity, can be built compact owing to the improvement of functional arrangement, giving the ship construction work a great convenience. Fuji Denki has supplied up to now units of this type to 12 ships, all being of motor and mechanical steering-main current direct control system, 220 V d-c.

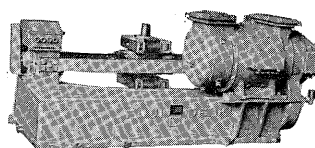


Fig. XI-16. 12 TM Screw Drive
Steering Engine

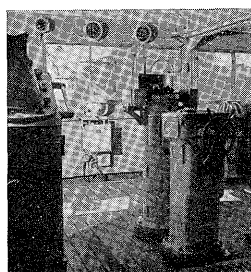


Fig. XI-17.
Steering Controller
on the Bridge of
Umitaka-Maru

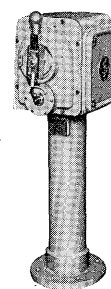


Fig. XI-18.
New Type Master
Controller for
d-c Cargo Winch

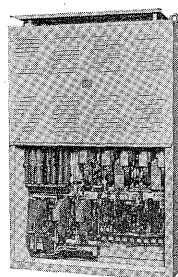


Fig. XI-19.
Magnetic Controller
for d-c Cargo Winch
under Desk Type

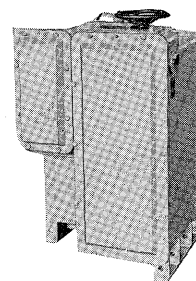


Fig. XI-20.
Main Current Direct
Controller on
Desk Type

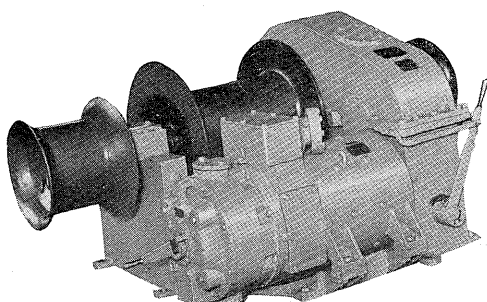


Fig. XI-21. Spur-gearred 2-Speed
System Winch

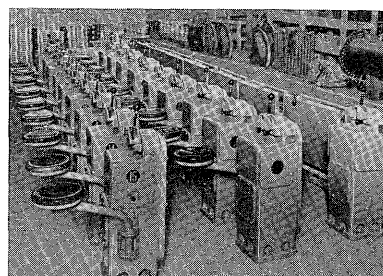


Fig. XI-22. Master Controller
for Leonard Winch

Besides them, the Company furnished S.S. Umitakamaru a training ship of Tokyo Fisheries University, with a screw drive steering engine rated at 9 TM-10 HP-22 sec., 440 V a.c., Ward-Leonard system, which is accompanied with an auxiliary direct control system of main current, 220 V d-c at an emergency case. This idea is to guarantee the reliability of the the equipment to its utmost.

This ship has two bridges: a fore steering bridge for navigation and a rear steering bridge for fishery

training and oceanic survey work, both being equipped with main steering controllers and emergency steering gears. At the fore bridge, an operator, controls the rudders normally in the Leonards system by steering a controller with follow up equipment, through a selsyn motor which if necessary, can be changed over to an auto pilot controller. In the bridge also are provided push button steering switches, through which the operator can directly control rudder motors on a ship's d-c source. On the other hand, the rear bridge has a motor or manually operated steering controller and upon changing-over of the circuit from the fore bridge, it immediately becomes operative of the steering control through Leonards system. In case of power failure of the supply source, it is indicated by a signal of the no voltage alarm and changing-over is made readily to use the very handle for the hand steering system.

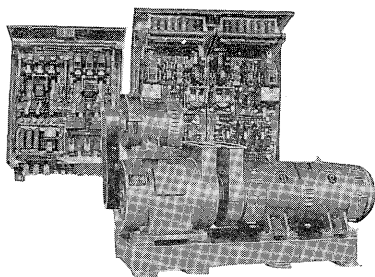


Fig. XI-23. Motor Generator and Control Panel for Leonard Winch

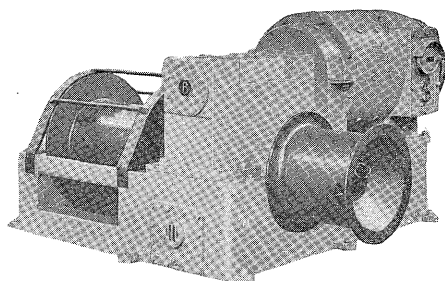


Fig. XI-24. Leonard Controlled Winch

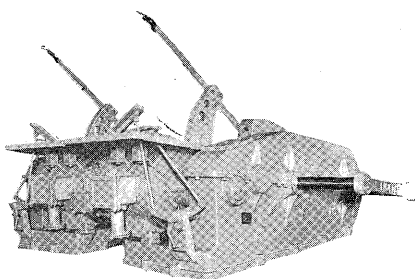


Fig. XI-25. Electric Whale Winch



Fig. XI-26. 120 HP Electric Trawl Winch

XI-3. ELECTRIC WINCHES

Our Company has manufactured a number of 220 V d-c winches which have worm geared one step reduction system of high efficiency, containing electro-magnetic control equipment within the body.

The winch has such features as excellent loading characteristics high efficiency, capability of operating 2 winches by one man etc. It will also withstand well severe over-load operation and its superiority is widely recognized in the circles.

The rated capacity is 57 HP for a 5T×40M/min. motor and 33 HP for a 3T×36 M/min. motor.

Lately, in consequence of studies and efforts to reduce price and weight, various new designs have been brought to completion, thereby we have manufactured many winches, the body of which being constructed of steel plate welded and the drip-proof controller being placed inside the hatch. The ratings are 41 HP for a 5T×30 M/min. motor and 25HP for a 3T×30 M/min. motor. European type winches, to be equipped on a ship for export are on demand, for which much effort is paid to simplify the construction. They are of spur-gearred 2 step reduction system, being capable of obtaining 2 kinds of loading speed by changing the gear. The control is of main current direct control systems, in which a Cam-type controller and resistors are placed in a waterproof box and installed on deck. Their ratings are of two kinds, 38 HP 5T×30 M/min.~2T×75 M/min. motor and 23 HP 3T×30 M/min.~1.5T×60 M/min. motor. A number of these units have been delivered heretofore. And further, in order to enable the operation of two winches by one man and facilitate the maintenance those of an electro-magnetic controlling system, to be operated by a master controller have been manufactured. Since our Company

accomplished the building of a-c 440 V winches by Leonard control, a-c electrification of deck machines, that had been a long pending question in shipping circles, has made a rapid development. Such various distinctive features of a-c equipment as not only excellent operating performance, but also reduction of weight and cost of ships are now widely recognized and from year to year the Company is receiving orders for good many numbers of units. This particular apparatus has been also kept improved to reduce the weight. By giving up a d-c generator attached to each common motor-generator for two winches for supplying power to the field and control circuit, only a common d-c supplying generator has been designed to operate for a group of common motor-generators.

For special application, the Company has manufactured a number of whale winches for whale catchers. The kinds were a hunting hoisting $5T \times 30$ M/min. which winds up a rope of the harpoon shot at a whale, a tail hoisting of 15 ton max. to take a shot whale into the ship, a 40 HP motor of 220 V d-c but now an improved new type winch is equipped with a 50 HP motor a whale winch of $6.2T \times 30$ M/min. tail hoisting 20T.

The trawl winch that was delivered to the training ship of Tokyo Suisan (Fisheries) University is of 220 V d-c 120 HP, in which two generator 100 V, 80 kW are installed as a power source, one of them being used as a booster to control speed, thus most smooth speed control being available in fishing.

XII. MEASURING INSTRUMENTS

XII.1. ELECTRICAL METERS

1) Indicating meters

In present day industry, in order to perform rational overall supervision, a demand for the manufacture of small type meters has become more and more important and to meet this demand, a wide-angle type switchboard instrument with long scale length in which the center of rotation of the pointer is located in the center of the instrument was accomplished. There are two sizes, namely 140 mm square and 100 mm square and each type comprises various types of instruments such as d-c ammeters and voltmeters, a-c ammeters and voltmeters, single and 3 phase wattmeters, 3 phase power factor meters, frequency meters, synchroscope, etc. Fig. XII.1

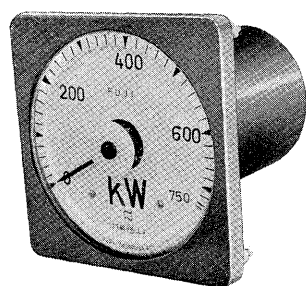


Fig. XII.1.
Wide Angle Type
Switchboard Instrument

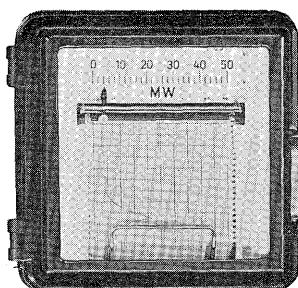


Fig. XII.2.
Ink Recorder

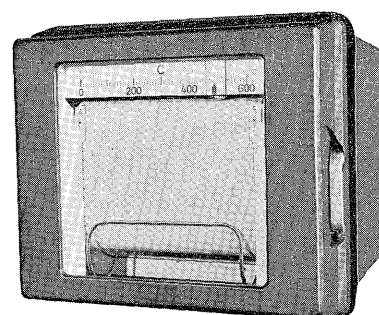


Fig. XII.3.
Self Balancing Type Recorder

illustrates one example of the above products.

The next stage in the manufacture of high precision electrical instrument was to construct a temperature and humidity controlled factory in which temperature is maintained at $20^{\circ} \pm 0.5^{\circ}\text{C}$, humidity between 55~60%, and room pressure maintained higher than the atmospheric pressure by approximately 6 mm of water column to prevent the entrance of dirt and dust. This factory has been now completed and the manufacture of precision instruments within this factory has begun lately.

2) Recording Meters

Although the manufacture of ink recorders was discontinued after the war, a small-sized ink recorder of 258 mm. square in size has been completed. The design by Siemens Co. was selected as an