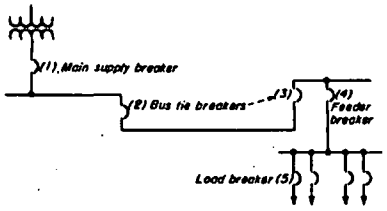
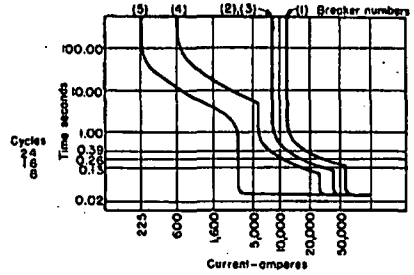
SELECTIVE DISTRIBUTION SYSTEM



1 Selective operation is obtained through use of calibrated tripping device, introducing time delay into each breaker



2 Tripping time of main supply breaker is greater than that of bus tie breaker, which in turn exceeds feeder breaker

in the circuit shown above. Referring to Fig. 2, breaker No. 5 will operate, clearing the fault, if the short circuit occurred beyond this breaker. Note that although the fault current passed through breakers 1, 2, 3 and 4, these breakers did not operate. Should the load breaker 5 fail to operate, or if the short circuit occurred between breakers 4 and 5, breaker 4 would operate in approximately 8 cycles. Complete selectivity at all times may be obtained in a chain of as many as four circuit breakers in series.

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Lighting Load. Ideal overload protection for a lighting system provides for uninterrupted service during periods of momentary overload. At the same time it provides immediate opening of the circuit in the event of a short circuit. Keep in mind the facts outlined in the following paragraph when selecting overcurrent protective devices for use in lighting circuit.

Incandescent. The incandescent lamp, when cold, has a resistance about 1/14 of that when it is hot. This causes a high inrush of current when the circuit is first closed. The most serious condition occurs in an alternating-current circuit when the breaker is closed with the voltage at its peak. Here, instantaneous current drawn is about 14 times normal value. This current is slightly less for lamps below 100 watts. In a direct-current circuit the inrush current is about seven times normal value. In either case the duration of the inrush current is short, varying from 2½ cycles in small lamps to 12 cycles in 1000-watt lamps.

To cope with this problem, circuit breakers are available that have a high tripping value for a short time after the breaker is closed. Shortly after the load current reaches its normal value, the tripping point of the breaker decreases to a value slightly greater than that of the normal current. In this manner, full protection is provided without unnecessary circuit interruption.

Mercury Vapor. Starting and operating characteristics of the mercury-vapor lamp, which requires a transformer or ballast on starting, are quite different from those of the incandescent lamp. The starting current of each type of lamp varies in peak value and duration. When operated with single-lamp transformers, the 400-watt Type H-1 lamp has a peak about 1.7 times normal and requires about 15 minutes to reach normal operating value. In contrast, the 2 lamp 400-watt style with ballast, has a starting current of 0.6 that of normal. This builds up to full current in about 25 min.

Fluorescent. Current behavior in fluorescent lamps is quite different from that in incandescent or mercury-vapor lamps. The starting current is practically normal. When the transformer comes into use, the peak is only 1.8 times normal. This high current lasts for only two or three cycles.

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Fuses. Where fuses are used to protect circuits, their rating should not be greater than the current-carrying capacity of the wire. The exception to this rule occurs when the current-carrying capacity of the wire does not correspond to a standard-size fuse; the nearest larger standard-size fuse may be used.

A variation from the above rule occurs in the application of fuse protection to motor circuits. All motors rated over 1 hp. must have running protection. Such security is offered by thermal cutout fuses, as well as those having large time-lag. The ordinary fuse on motor circuits protects only against short circuit. The thermal device, which offers running protection to the motor, also protects the feeders against overload.

ACKNOWLEDGMENTS

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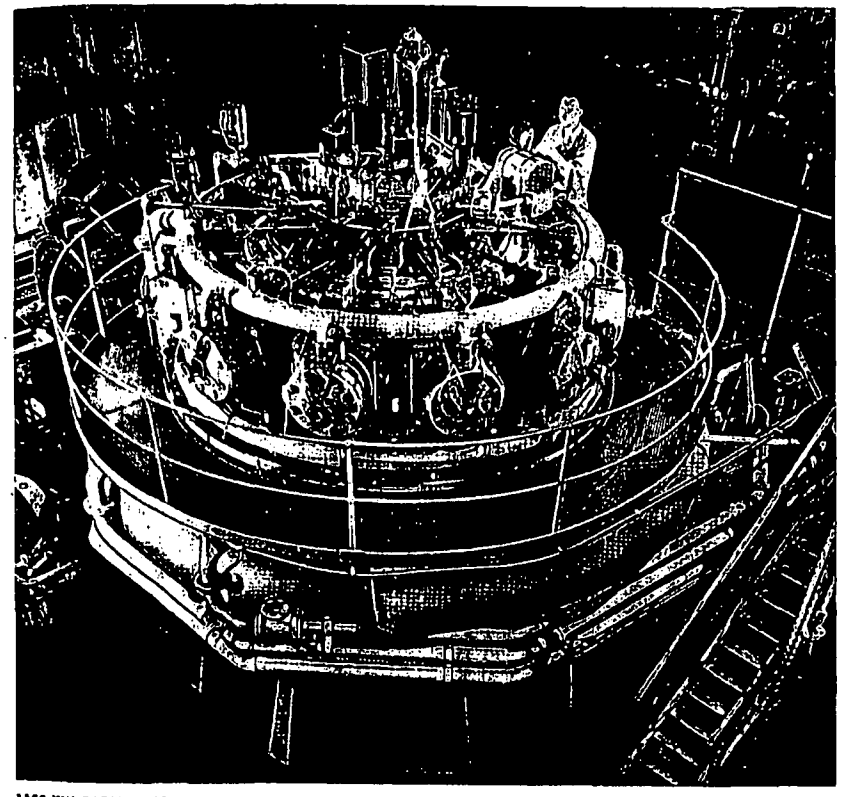

1150-KW RADIAL ENGINE GENERATOR installed for experimental purposes at Aluminum Ore Co plant. New units are similar

Radial Engines for Aluminum Works

▶ A LARGE RADIAL ENGINE-GENERATOR, embodying many unusual design features, was shown to diesel engineers attending the 20th national conference of the Oil and Gas Power Division, ASME, held at St. Louis, May 20-22. Built by Nordberg Mfg Co, and operating two years at East St. Louis plant of the Aluminum Ore Co, this unit is the prototype of 80 similar engine-generator sets recently ordered by the Aluminum Co of America to form the power plant for two pot lines to be installed at a Texas site.

Developed in cooperation with the Aluminum Co, the radial design is said to have features making it particularly suitable for continuous heavy-duty service in plants of large total capacity. Experience with internal-combustion engines for pot-line power production was gained by Alcoa in building and operating the Defense Plant Corp plant at Jones Mills, Ark., believed to be the present world's largest internal-combustion-engine plant. Two of its four pot lines are supplied by transmission line and rectifiers, the others by 18 Nordberg gas diesels of the high-pressure injection type, and by 50 Cooper-Bessemer spark-ignition gas engines. Total engine-generator capacity is 78,000 kw. For a complete description of this plant, now owned by Reynolds Metals Corp, see POWER, Nov 1944 pp 64-69.

(*Continued on page 98*)